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ABSTRACT

Selected elements of reading and psychomotor characteristics among good and poor readers of divergent intellectual abilities were investigated. Four groups were selected for study: good and poor readers who were of average ability, and good and poor readers who were mentally handicapped. Approximately 160 subjects were identified for testing, and the final population was composed of 127 subjects with mental ages of about 9 years. Tests were given in the following areas: auditory discrimination, visual word discrimination, reading, visual perception, learning aptitude, visual-motor integration, associative learning, lateral dominance, and visual-motor retention. The results indicated that good and poor readers were often differentiated on measures of reading; they were infrequently differentiated on measures of psychomotor characteristics. Poor reading retarded children were substantially inferior to the other groups on measures of reading skills. The interrelationships among the measures of reading were such that it was difficult to identify specific deficits. A bibliography and tables are given. Included in the appendix is a paper entitled "Visual and Auditory Perceptual Factors in Reading." (DE)

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READING AND PSYCHOMOTOR DISABILITY AMONG MENTALLY RETARDED AND AVERAGE CHILDREN

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School of Education
The University of Connecticut
Storrs, Connecticut

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John F. Cawley
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INTRODUCTION

In recent years, specialists in the behavioral sciences have become greatly concerned with the characteristics of children who experience difficulty in academic achievement, particularly in the area of reading.

The search for meaningful correlates of language and reading achievement deficiencies has led to the development of specialized interest areas, which have been grouped under the generic terms of learning disabilities, perceptually handicapped, and so forth. Attention to these areas has given reading clinicians and remedial specialists a more comprehensive diagnostic and treatment base.

As is necessary when new areas of concern emerge, interested specialists group together to define the parameters of the problem and move toward formal action. Within the framework of definition, the area of learning disability suggests that one of its major parameters is intelligence. The learning disability concept apparently applies to children with normal intelligence, near normal intelligence, or the potential for normal intelligence. Indeed, this is strange because the inference seems to be that these children have learning disabilities that can be remediated and those outside of these limits do not; or that these children have learning disabilities that are unique and different from those of children below those limits; or that the child with below average intelligence is disabled because of limited intellectual capacity and, therefore, not acceptable for evaluation and treatment by specialists; or, that the needs of subaverage children are being met.

Fundamental to this issue is I.Q. and the role it plays in attitude formation among behavioral scientists and the role it plays in the development of educational practice. The intelligence quotient is an estimate of the rate at which a child, or group of children, develops. When the developmental level of a child with high I.Q. is considerably below his expectancy, the discrepancy is attributed to everything but I.Q.; when the developmental level of a child with subaverage I.Q. is below expectancy, we ignore all other factors and attribute this lag to the lower I.Q. This is fallacious. We have already recognized the differences in the expected rate of development when we acknowledged I.Q. The problem is more than intelligence when achievement is below expectancy. The problems of the slow learner should be responded to as any other child's, with diagnosis and treatment by specialists who are competent to deal with the deficits manifest in the child.

Intelligence then, has a developmental, or curriculum, role to play in education. It does not have an instructional role. By this, we mean that variation in I.Q. is compensated for by the development of different curricula in the schools. Nowhere is there any suggestion that the instructional process - that is, the method by which a child is taught to read, or to do arithmetic - is markedly different for children of average or below average intelligence.

The argument that the needs of children with lower intelligence quotients are being met by special education simply does not hold water. The teacher of the child with lower than average ability is trained to make curriculum adjustments for the children under her jurisdiction in much the same manner as the teacher who works with children of average or above average ability. There is no basis for the argument that the teacher of the child with a lower measured level of intelligence should possess the skills that are necessary to provide remedial assistance. Children with mental abilities that are measurably below average, particularly in the inner city, are not having their needs met by special education. There are too many of them, in too concentrated a system, in a situation where education has not, as yet, committed a sufficient amount of its resources. The special teacher's competencies in remedial and diagnostic techniques are of a level resembling those of the regular teacher. Accordingly, the skills of specialists are needed to support this teacher, just as they are any other teacher.

The competencies, and the application of these competencies, to meet the needs of children is the basis for specialists in education. If a given teacher, or specialist, has competencies that can help a child to be a more effective individual, then these competencies should be utilized to help this individual.

It is difficult to reconcile the confusion which exists among the labels assigned to children (e.g. mentally retarded, perceptually handicapped) and the certainty which appears to characterize the differentiated certification for specialists in education. One assumes that certification expresses confidence in the ability of the specialist to "treat" disabilities that fall within the realm of his acquired competencies. One must also assume that responsible educational practices result with the assignment of a child to a specialist. The validity of these assumptions certainly requires further examination.

In some instances, the educational progress of children is lacking even after intensive treatment. In these instances, alternatives to diagnosis and treatment would seem to be in order. One case which highlights the dilemma under discussion is cited by Johnson and Myklebust (1967) who suggest that children included in the learning disability group should attain an I.Q. of 90 on either a verbal or non-verbal measure, because this is a more accurate and effective means for differentiating between the mentally retarded and those with learning disabilities. The authors go on to cite the case of one boy with a verbal score of 120 and a non-verbal score of 68. After six years of specialized training, his ability to function in society was apparently inadequate; the authors suggest that he might be mentally retarded. This appears to be a case of "peuedo-learning disability." The historical counterpart of this condition was the "pseudo-feebleminded" child, a situation in which the child's label was contingent upon subsequent educational success or failure. When the child performed in accordance with the diagnosis, the diagnosis was confirmed. If he performed beyond the levels associated with the mentally retarded, the diagnosis was not confirmed and the child was referred to as "pseudo-feebleminded." In the case under discussion, the child's performance was inconsistent with the diagnosis. Inasmuch as his verbal intelligence quotient was 120 and he failed to perform accordingly, he might possibly be classified as a case of "pseudo-learning disability." This raises serious questions concerning the predictive validity of educational labels.

It is appropriate and necessary to distinguish the developmental lag of the mentally retarded and slow-learner from that of average or above average children. We do not question this. What we question is the exclusion of children from special services (e.g. remedial and clinical experiences) whose performance characteristics indicate that they are not functioning to the limits of their capability.

The present investigation was developed in order to obtain information pertinent to the correlates of reading disability among children of divergent mental abilities. This was viewed as important because it was anticipated that a new focus could be developed with regard to the nature of instructional practices with children. It was thought to be desirable to clarify some of the notions extended herein because of the potential negative influence which inappropriate instructional procedures may tend to have upon the mental health, social adjustment and academic achievement of children.

In addition to those children whose disabilities appear to be of an instructional nature, other children may be predisposed to learning disabilities related to differences in psychomotor characteristics. When children with divergent mental abilities are identified as having a reading disability, there is a frequently noticed tendency to treat the child with average or above average intelligence and to ignore the child with below average ability. This is done because many professionals tend to view learning disabilities and subaverage intellectual abilities as one and the same. Although reading disabilities in children have been the focal point of numerous investigations, information leading toward a more accurate understanding of the nature of reading disability in groups with varying intellectual capacities is presently insufficient. Noticeably lacking in the available literature are comparisons of good and poor readers with divergent mental abilities. An exhaustive and comprehensive review of the related literature (Cawley, 1967; Cawley, and Pappanikou, 1967) has failed to yield an investigation developed under the paradigm of the present proposal - a fourfold design comparing both good and poor readers of different intellectual levels. Accordingly, the following questions were raised relevant to the proposed investigation:

1. Do the reading and selected psychomotor characteristics which tend to discriminate between good and poor readers among children of average ability, discriminate in the same manner among good and poor readers among mentally handicapped children?

2. Are there certain similarities and differences in the reading processes and psychomotor characteristics of average children who are good readers and mentally handicapped children who are good readers, as well as patterns reflecting similarities and differences among average children and mentally handicapped children who are poor readers?

This notion of differentiation of good and poor readers among mentally retarded and average children is essential if we are to provide teachers with an understanding of the methodological and curriculum implications for the teaching of reading. It is also important to future research efforts into reading processes of those children because, with a clearer understanding of the characteristics which separate good and poor readers, we can then proceed to develop classroom procedures which may fall within the framework of some usable models. With a clearer understanding of the nature and correlates of reading ability and disability among average and retarded children, specific approaches to instruction and remediation can be conceptualized and implemented.

RELATED LITERATURE

DiCarlo (1958) has compared achievers and non-achievers among children with retarded mental development. This investigation compared 50 achievers and 50 non-achievers on tasks measured by intelligence, personality, and speech and language characteristics. The list of identified differences and no differences from the DiCarlo study is too extensive to include. The study emphasized personality and language implications, which to a considerable extent did not demonstrate significant differences.

Daly and Lee (1960) analyzed the reading habits of 77 mentally handicapped children with mental ages from 6-1 to 12-7 and found 38 per cent characterized by reading retardation, disability being defined as a discrepancy between mental age and chronological age. This analysis was followed by a remedial program wherein speed and regular classroom and special concentrated techniques were utilized with an experimental group. No significant differences were found between experimental and controls. It should be noted, however, that no estimate was made of any psychomotor deficiences and the remedial program which might relate to their characteristics.

Bright and dull children with approximately equal mental ages were compared with respect to each of several abilities involved in reading comprehension (Bleismier, 1954). Bright children were found to be significantly superior to dull children in total reading comprehension, memory for factual details and listening comprehension; all factors, incidentally, which may be closely related to attention span and memory, which were not controlled. Bright children were significantly superior to dull children in more complex and intellectual comprehension abilities. No differences were found on word recognition and work meaning.

Stauffer (1948) investigated a variety of psychological manifestations of average children who were retarded readers and found language development, associative learning characteristics and selected attention span and memory factors to discriminate between the groups. The variables included in the Stauffer study are among those being utilized in the proposed investigation. A significant contribution relative to the validity of Stauffer's work should be realized if similar patterns are found among mentally handicapped children who are retarded readers and not among those who are good readers.

In an extensive analysis of the reading characteristics of mentally retarded and average children of the same mental ages, Dunn (1956) found the normal group to perform better on all measures of silent and oral reading and the ability to use context clues. Fewer faulty vowels, sound omissions, and words added, favored the normal group. Teachers of the retarded groups indicated more social and personal problems among these children. No attempt was made to evaluate the role of instruction relative to the deficiencies exhibited by the retarded groups, nor to compare the status of good and poor readers.

Auditory memory span has been shown to be inadequately developed or functioning among poor readers (Vernon, 1957) and tests of auditory attention span are considered to be more difficult for a large percentage of children with reading problems. Rose (1958) reports deficient auditory memory for retarded readers on an item requiring the subject to "give two reasons why children should obey their parents." A principal cause of failure was the inability of the subject to give two reasons unless specifically reminded to do so. In spite of the fact that they received failure scores, many of the subjects were able to give two reasons if their attention was re-directed to the task.

The performance of retarded readers on the Illinois Test of Psycholinguistic Abilities was measured by Kass (1962), who found that children with reading disabilities tended to have more deficiencies at the automatic-sequential level than at the representational level, as well as more problems in association than in decoding or encoding.

Sheperd's (1967) comprehensive study of reading ability among retarded children who were classified as "adequate" and "inadequate" readers showed that the two groups were differentiated more on measures of reading than on measures of developmental status. Adequate readers were significantly different from inadequate readers on (1) silent and oral reading, (2) use of context clues, (3) sound blending, and (4) on the fact that they made fewer errors on faulty vowels, faulty consonants, reversals, omission of sounds, substitution of words, words aided and words refused. No significant differences were noted in: (1) auditory discrimination, (2) memory for designs, (3) visual closure, (4) on psycholinguistic characteristics such as auditory-vocal automatic and auditory-vocal sequencing, and (5) measures of lateral dominance.

Shotick (1960) provides additional basis for elaboration on the reading problems of the mentally retarded. This investigator matched twenty-two pairs of retarded and normal subjects in mental age (mean = 104.95 months and 105.36 months) and on reading age (mean 104.27 months and 104.73 months). In spite of the fact that there were no differences in reading comprehension in the original match and in reading vocabulary in the study, normal boys were significantly superior to retarded boys on all measured reading skills (e.g. utilizing context clues, interpreting figurative language). There were no differences on the psychomotor tasks.

This review of selected relevant literature reveals a failure or research workers to have examined reading ability and/or disability within the frame of reference of the present study. The investigators failed to uncover a project similar in design or rational to the one described herein.

PROCEDURE

In accordance with the objectives of the study, two samples with two subgroups in each were identified. The mentally retarded and average samples were located in several major population centers. In each of these cities, special class pupils within the desired mental age range were selected for study. Selected average subjects also meeting the basic requirements were then chosen from the same districts.

The term "mentally handicapped" refers to those subjects whose measured intelligence falls within a range which when placed in perspective relative to derived data yielded a mental age of approximately 9 to 10 years. The subjects were also enrolled in a special class for the mentally handicapped. The term "average" refers to those subjects whose measured intelligence which when placed in perspective relative to derived data yielded a mental age of approximately 9 to 10 years.

Approximately one hundred and sixty subjects were identified for testing in this manner. The complete testing battery is included in Figure 1. No child was tested for more than one hour per day and all testing was completed within a two-week period.

After the data were collected, all tests were scored and subsequently punched onto data processing cards for statistical analyses. The final population was reduced to one hundred and twenty-seven subjects as a result of incomplete data collection on some subjects.

Descriptive data for the four samples are contained in Table 1.

TABLE 1

DEVELOPMENTAL CHARACTERISTICS

		Good	Poor
Average	CA	$\bar{X}$ 121.52	$\bar{X}$ 121.68
	IQ	$\bar{X}$ 102.56	$\bar{X}$ 98.36
	MA	$\bar{X}$ 124.68	$\bar{X}$ 120.00
	RA*	$\bar{X}$ 126.12	$\bar{X}$ 96.96
Mentally Retarded	CA	$\bar{X}$ 167.96	$\bar{X}$ 164.32
	IQ	$\bar{X}$ 68.00	$\bar{X}$ 69.80
	MA	$\bar{X}$ 113.44	$\bar{X}$ 114.24
	RA	$\bar{X}$ 113.40	$\bar{X}$ 83.76

*RA (Reading Age) = 60 months + Grade Level X 12

The investigator's model postulated that the same reading and psychomotor characteristics discriminate good and poor readers among children of average intellectual endowment and good and poor readers who are mentally handicapped. Implicit in this model is the belief that there are certain similarities and differences in the patterns of performance of good readers at different intellectual ability levels and poor readers at different intellectual ability levels.

Two-way analysis of variance, 2 x 2 factorial design employing a fixed model (Ferguson, 1959), was intended to be the main statistical design utilized. However, because of unanticipated sampling considerations, the average sample had significantly higher mental ages and reading ages than the handicapped sample. These differences may effect performance on the dependent variables under study. No such effects attenuate the comparisons between good and poor readers.

The alternate hypothesis implicitly tested in this study was that average children would be superior to handicapped children and that good readers would be superior to poor readers on the dependent variables. Any differences in the

FIGURE 1

Instrumentation Utilized for the Assessment of Psychoeducational Characteristics of Average and Mentally Handicapped Good and Poor Readers

Gates-McKillop Reading Diagnostic Tests (GM)

- I. Oral Reading
  - A. Total Reading
  - B. Diagnostic Errors
    - 1. Omission of Words
    - 2. Addition of Words
    - 3. Repetition of two or more consecutive words
    - 4. Mispronunciations of words (all types)
    - 5. Reversals of words
- II. Flash Presentation of Words
- III. Untimed Presentation of Words
- IV. Knowledge of Word Parts
  - A. Recognizing and Blending Common Word Parts
  - B. Giving Letter Sounds
  - C. Identifying Capital Letters
  - D. Identifying Lower-Case Letters
- V. Recognizing the Visual Form or Word Equivalents of Sounds
  - A. Nonsense Words
  - B. Initial Sounds
  - C. Final Sounds
  - D. Vowel Sounds
- VI. Auditory Blending
- VII. Syllabication
- VIII. Auditory Discrimination

Gottschaldt Embedded Figures Test

Van Wagenen - Czech Words

Goodstein Language Acquisition Determinant (GLAD)

- I. Multiple-Choice
- II. Free Response
- III. Total

Gates Associative Learning Test

- I. Visual-Visual (geometric)
- II. Visual-Visual (word-like)
- III. Visual-Auditory (geometric)
- IV. Visual-Auditory (word-like)

Developmental Test of Visual Perception (DTVP)

- I. Eye-Motor Coordination
- II. Figure-Ground
- III. Constancy of Shape
- IV. Position-in-Space
- V. Spatial Relationships
- VI. Total

Harris Tests of Lateral Dominance

- I. Knowledge of Left and Right
- II. Hand Preferences
- III. Simultaneous Writing of Numbers

Detroit Tests of Learning Aptitude (DTLA)

- I. Verbal Opposites
- II. Auditory Attention Span for Unrelated Words
- III. Visual Attention Span for Objects
- IV. Auditory Attention Span for Related Words
- V. Visual Attention Span for Letters
- VI. Oral Directions

Informal Visual Word Discrimination Test

Wepman Auditory Discrimination Test (WAD)

Beery Visual-Motor Integration Test

Benton Revised Visual Retention Test

- I. Total Correct
- II. Total Incorrect
- III. Error Scores by Type of Error

analysis of variance which demonstrated average children to be superior to handicapped children were exposed to multiple regression analysis to further test the appropriate null hypothesis, that no differences between the samples existed.

Multiple regression analysis "covaries" the criterion variables, reading age and mental age, with the dependent variable. A multiple regression equation was calculated predicting the dependent variable from the multiple covariates. This was done separately for the mentally handicapped-good, and average-good readers and the mentally handicapped-poor, and normal-poor readers. Residual scores representing the unpredicted variance, coming from "treatment" and "error" sources, were converted to standard scores for the two distributions. "t" tests were taken between mentally handicapped-good and average-good readers and between the poor readers. Two degrees of freedom were lost for these comparison, since two covariates were employed.

For all analyses, the rigorous level of confidence of .99 with a two-tailed test were employed, even though the hypotheses were essentially unidirectional. This rigor seems necessary in view of the loss of power of a test in discriminating between individual cases, even when it may discriminate mean scores.

Results and Discussion[1]

The basic proposition underlying this study was that differences between mentally handicapped and non-mentally handicapped good readers and that differences between mentally handicapped and non-mentally handicapped poor readers would occur primarily on measures of reading; differences would not consistently occur on measures of psychomotor characteristics. In accordance with this position, the results of this study are reported in three sections. The first section considers the inter-group comparisons on measures of reading. The second section focuses on the inter-group comparisons on measures of psychomotor characteristics. The third section contains an analysis of the intercorrelations and structural configuration of the measures employed in this study.

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[1] The computational part of this work was carried out in the Computer Center of The University of Connecticut which is supported in part by Grant GJ-9 of the National Science Foundation.

Reading Comparisons

The primary data source in this section is the Gates-McKillop Reading Diagnostic Tests.

Table 2 contains the grade-equivalent scores on oral reading of paragraphs, for the four samples that were compared in the present study. This measure is the dependent variable in this investigation. In spite of prior screening on group reading scores, the individual test scores do not provide a match comparable to

TABLE 2

GRADE-EQUIVALENT SCORES IN ORAL READING

		Good	Poor
Average	$\bar{X}$	5.51	3.08
	SD	.98	.55
Mentally Retarded	$\bar{X}$	4.45	1.98
	SD	1.27	.39

Grade-Equivalent Scores	F	p
Retarded-Average	38.52	.01
Good-Poor	198.31	.01
IQ x Reading	0.02	NS

that which was originally sought. There are significant differences in the expected good-poor comparisons. The relative good-poor difference in reading ability is about equal for the average and retarded samples. Poor reading average children demonstrated a mean reading grade equivalent of 3.08, 2.43 grade levels below the good reader average sample. Poor reading retarded children had a mean grade equivalent of 1.98, which is 2.47 grade equivalent levels below the good reading retarded sample. The reading performance of good readers approximates their mental age, whereas the reading grade equivalent of the poor readers is greater than two years below mental age.

Tables 3 through 7 contain data for the analyses for five types of reading errors that were recorded during oral reading. The data in these tables are reported in terms of total number of errors. It is clear from the data relative to omissions and mispronunciations, Tables 3 and 4, that the poor reading mentally handicapped child manifests numerous errors. Not only are there significant differences between good-poor, and retarded-average comparisons, but there is also

TABLE 3

ORAL READING ERROR SCORES: OMISSIONS

		Good	Poor
Average	$\bar{X}$	.52	1.72
	SD	.71	1.65
Mentally Retarded	$\bar{X}$	.68	1.74
	SD	.85	2.22

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	12.66	.01	Good-Good	-.19	NS
Good-Poor	16.20	.01	Poor-Poor	-1.25	NS
IQ x Reading	12.15	.01			

TABLE 4

ORAL READING ERROR SCORES: MISPRONUNCIATIONS

		Good	Poor
Average	$\bar{X}$	1.68	10.76
	SD	1.11	6.65
Mentally Retarded	$\bar{X}$	4.36	21.44
	SD	3.52	11.08

Raw Scores	*F*	*p*	Residual Scores	*t*	*p*
Retarded-Average	24.71	.01	Good-Good	-1.85	NS
Good-Poor	94.74	.01	Poor-Poor	-2.67	NS
IQ x Reading	8.86	.01			

a significant interaction. Retarded-average scores were converted to residual scores and subjected to statistical treatment. No retarded-average differences were observed after this treatment. When the retarded reader's error score was adjusted to compensate for his relatively lower mental age and reading age, he was no more prone to make this type of error than his non-handicapped counterpart. Although no statistical tests can be made, interaction would probably disappear as retarded-average differences are eradicated.

An analysis of repetition and reversal errors, Tables 5 and 6, shows significant good-poor reader differences. There are no significant mentally retarded-average differences.

TABLE 5

ORAL READING ERROR SCORES: REPETITIONS

		Good	Poor
Average	$\bar{X}$	.08	1.40
	SD	.28	1.83
Mentally Retarded	$\bar{X}$	.08	.56
	SD	.28	1.00

Raw Scores	*F*	*p*
Retarded-Average	3.93	NS
Good-Poor	18.03	.01
IQ x Reading	3.93	NS

TABLE 6

ORAL READING ERROR SCORES: REVERSALS

		Good	Poor
Average	$\bar{X}$	.00	.56
	SD	.00	1.12
Mentally Retarded	$\bar{X}$	.04	1.12
	SD	.20	.97

Raw Scores	*F*	*p*
Retarded-Average	4.02	NS
Good-Poor	30.02	.01
IQ x Reading	3.02	NS

TABLE 7

ORAL READING ERROR SCORES: ADDITIONS

		Good	Poor
Average	$\bar{X}$	.36	.44
	SD	.76	.71
Mentally Retarded	$\bar{X}$	.24	.48
	SD	.52	.96

Raw Scores	F	p
Retarded-Average	.07	NS
Good-Poor	1.12	NS
IQ x Reading	.28	NS

Table 7 presents data for the four samples on errors that involved the insertion of additional words. The overall oral reading pattern tends toward significant differences between good-poor readers. The pattern of differences for the mentally retarded-average comparison seemed related to their oral reading abilities. The poor reader among the retarded children is severely handicapped on oral reading ability.

Word recognition is assessed, out of context, in flash and untimed presentations. In the former, words are tachistoscopically presented, whereas the latter has no time limit. The untimed presentation provides the examiner with an opportunity to observe the pupil's use of word attack skills when he is attempting to identify unknown words. In each of these analyses, there are significant retarded-average and good-poor differences. In retarded-average data, because of differences in mental age and reading age, were treated from the residual scores. No differences were observed.

TABLE 8

WORD RECOGNITION: FLASH PRESENTATION

		Good	Poor
Average	$\bar{X}$	30.92	18.24
	SD	5.82	4.36
Mentally Retarded	$\bar{X}$	24.52	9.64
	SD	7.32	4.54

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	44.29	.01	Good-Good	.24	NS
Good-Poor	149.50	.01	Poor-Poor	2.01	NS
IQ x Reading	.95	NS			

TABLE 9

WORD RECOGNITION: UNTIMED PRESENTATION

		Good	Poor
Average	$\bar{X}$	67.84	43.04
	SD	9.33	13.54
Mentally Retarded	$\bar{X}$	53.36	19.72
	SD	14.91	11.36

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	57.48	.01	Good-Good	.20	NS
Good-Poor	137.39	.01	Poor-Poor	1.06	NS
IQ x Reading	3.14	NS			

Letter recognition performance for the four samples is presented in Tables 10 and 11. These are relatively easy tasks in which the child is instructed to identify the letters of the alphabet. This particular task should not be underestimated for it makes a substantial contribution to success in beginning reading (Cawley and Goodstein, 1968). No significant differences are noted among the various samples. In each instance, ceiling effects are obvious.

TABLE 10

LETTER RECOGNITION: CAPITAL LETTERS

		Good	Poor
Average	$\bar{X}$	25.84	25.76
	SD	.37	.52
Mentally Retarded	$\bar{X}$	25.96	24.16
	SD	.20	3.90

Raw Scores	F	p
Retarded-Average	3.49	NS
Good-Poor	5.64	NS
IQ x Reading	4.72	NS

TABLE 11

LETTER RECOGNITION: LOWER-CASE LETTERS

		Good	Poor
Average	$\bar{X}$	25.88	25.44
	SD	.33	.92
Mentally Retarded	$\bar{X}$	25.92	24.48
	SD	.40	3.61

Raw Scores	F	p
Retarded-Average	1.50	NS
Good-Poor	6.26	NS
IQ x Reading	1.78	NS

Recognizing and blending common word parts is another important skill in reading. In this particular test, the child is directed to phonetically structured, but non-meaningful words (e.g. spack). The child is asked to pronounce each stimulus word. These data, Table 12, show marked deficits among poor readers and between retarded and average children. The poor reading retarded child shows an absolute deficit in this area. Significant differences between average and retarded poor readers are maintained after treatment of the residual scores.

TABLE 12

RECOGNIZING AND BLENDING COMMON WORD PARTS

		Good	Poor
Average	$\bar{X}$	17.00	5.36
	SD	5.05	6.87
Mentally Retarded	$\bar{X}$	5.44	0.0
	SD	7.75	0.0

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	53.92	.01	Good-Good	-.45	NS
Good-Poor	54.94	.01	Poor-Poor	4.90	.01
IQ x Reading	7.24	.01			

Vowel identification, Table 13, is assessed by having the child listen to a word and by having him point to the vowel, in visual form, which represents the sound in the middle of a stimulus word. Significant differences and a significant interaction are observed in the data. Retarded-normal differences were not significant after treatment of residual scores.

TABLE 13

RECOGNIZING THE VISUAL FORM OF SOUNDS: VOWEL IDENTIFICATION

		Good	Poor
Average	$\bar{X}$	8.32	7.28
	SD	1.49	1.95
Mentally Retarded	$\bar{X}$	6.88	3.76
	SD	1.76	2.40

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	41.27	.01	Good-Good	-1.58	NS
Good-Poor	29.03	.01	Poor-Poor	-1.04	NS
IQ x Reading	7.26	.01			

Auditory blending, Table 14, is one of the basic skills in the reading process. The child listens to fragmented real words and blends the individual sounds into whole words. On this ability, there are significant differences between good and poor readers and between the retarded and average samples. In the

TABLE 14

AUDITORY BLENDING

		Good	Poor
Average	$\bar{X}$	12.84	11.08
	SD	1.97	3.53
Mentally Retarded	$\bar{X}$	10.72	6.80
	SD	3.05	3.76

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	25.70	.01	Good-Good	-2.45	NS
Good-Poor	20.24	.01	Poor-Poor	-1.44	NS
IQ x Reading	2.93	NS			

latter instance, treatment of the derived residual scores resulted in the differences being reduced to a non-significant level.

The ability of the child to analyze syllables in the process of word formation is another component of the reading process. These data, Table 15, show that good readers are significantly superior to poor readers, as measured in this investigation. The retarded-average comparisons do not yield significant differences after treatment of residual scores.

TABLE 15

SYLLABICATION

		Good	Poor
Average	$\bar{X}$	16.72	7.64
	SD	3.89	5.35
Mentally Retarded	$\bar{X}$	8.16	.84
	SD	7.09	2.01

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	60.15	.01	Good-Good	-2.20	NS
Good-Poor	68.57	.01	Poor-Poor	1.67	NS
IQ x Reading	.79	NS			

In reading, a child often finds it necessary to associate a letter with its sound. Table 16 presents the results of an assessment of the ability of subjects to perform one of these tasks. In this instance, Table 16, the subject is shown the letter of the alphabet and requested to give the sound of the letter. Letter names are not acceptable. Perfect scores, providing the proper sound for all twenty-six letters, were uncommon. Mentally retarded poor readers were particularly inferior in this task. Treatment of the residual scores did not maintain the difference in favor of the average children.

TABLE 16

LETTER SOUNDS

		Good	Poor
Average	$\bar{X}$	20.88	22.28
	SD	4.52	2.46
Mentally Retarded	$\bar{X}$	22.28	15.28
	SD	2.84	6.40

Raw Scores	*F*	*p*	Residual Scores	*t*	*p*
Retarded-Average	15.48	.01	Good-Good	1.24	NS
Good-Poor	6.29	NS	Poor-Poor	-3.01	.01
IQ x Reading	16.96	.01			

Additional measures of the ability to associate letter symbols with letter sounds are contained in Tables 17 and 18. The examiner reads a word to a child

TABLE 17

INITIAL SOUNDS

		Good	Poor
Average	$\bar{X}$	18.04	17.16
	SD	1.21	2.23
Mentally Retarded	$\bar{X}$	17.48	15.20
	SD	2.00	2.97

Raw Scores	*F*	*p*	Residual Scores	*t*	*p*
Retarded-Average	8.24	.01	Good-Good	-1.74	NS
Good-Poor	12.95	.01	Poor-Poor	- .50	NS
IQ x Reading	2.54	NS			

TABLE 18

FINAL SOUNDS

		Good	Poor
Average	$\bar{X}$	11.68	10.84
	SD	1.93	2.29
Mentally Retarded	$\bar{X}$	10.08	7.96
	SD	2.36	2.88

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	21.00	.01	Good-Good	-1.22	NS
Good-Poor	9.66	.01	Poor-Poor	-1.63	NS
IQ x Reading	1.80	NS			

and he is required to identify the letter that makes either the beginning or the final sound in the word. In each of these measures, there are significant good-poor differences, as well as significant differences in the retarded-normal analyses. Treatment of residual scores for the retarded-normal comparisons produced a pattern that did not show significant differences.

Associating the visual form of sounds is an element of the reading process that is frequently included in individual diagnostic appraisals. The specific strategy that is used to assess this skill requires the child to listen to a sound that is pronounced by the examiner. The child must identify the sound, a nonsense syllable, that is associated with this sound (e.g. bibble). Differences between good and poor readers are significant at the .01 level of confidence. Raw score differences between retarded and normal children are significant at the .01 level, but tests of significance that were applied to residual scores did not yield statitically significant patterns.

TABLE 19

NONSENSE WORDS

		Good	Poor
Average	$\bar{X}$	17.40	14.08
	SD	2.36	2.97
Mentally Retarded	$\bar{X}$	15.08	10.72
	SD	2.78	3.51

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	23.42	.01	Good-Good	-1.01	NS
Good-Poor	42.81	.01	Poor-Poor	- .65	NS
IQ x Reading	.79	NS			

Visual discrimination of word forms was measured in this investigation. The task requires the subject to identify the one word out of four that did not match a given standard. There are no significant differences. Each of the four samples demonstrate near perfect performance. Perceptual level tasks such as this do not seem to differenciate among the four samples.

TABLE 20

INFORMAL VISUAL WORD DISCRIMINATION

		Good	Poor
Average	$\bar{X}$	28.12	27.84
	SD	1.99	1.97
Mentally Retarded	$\bar{X}$	27.92	26.48
	SD	2.41	2.97

Raw Scores	F	p
Retarded-Average	2.71	NS
Good-Poor	3.29	NS
IQ x Reading	1.49	NS

Two measures of auditory discrimination are employed. Table 21 contains the data for the auditory discrimination test of the Gates-McKillop, and Table 22 has the means and standard deviations for the Wepman Auditory Discrimination Test. There are no overall differences among the various comparisons on the Gates-McKillop, although significant differences are reported on the Wepman data.

TABLE 21

AUDITORY DISCRIMINATION (GM)

		Good	Poor
Average	$\bar{X}$	11.80	12.28
	SD	2.42	1.99
Mentally Retarded	$\bar{X}$	12.08	10.92
	SD	1.63	1.71

Raw Scores	F	p
Retarded-Average	1.89	NS
Good-Poor	.75	NS
IQ x Reading	4.37	NS

TABLE 22

AUDITORY DISCRIMINATION (WAD, TOTAL)

		Good	Poor
Average	$\bar{X}$	36.32	35.04
	SD	1.60	2.54
Mentally Retarded	$\bar{X}$	35.04	30.16
	SD	3.45	5.10

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	20.24	.01	Good-Good	-2.41	NS
Good-Poor	20.24	.01	Poor-Poor	-2.16	NS
IQ x Reading	6.92	.01			

The occurrence of differences on one test and not on the other is a cause for some concern, of one expects to generalize data. The tests are similar in technique in that the manner of stimulus presentation and response requirements are similar. A pair of words is presented to the subject and he is instructed to determine whether words in the pair are the same (e.g. bug-bug) or different (bug-bag). Neither test has norms. The Wepman is longer than the Gates-McKillop, a fact which tends toward greater reliability, but also a fact that provides for a greater number of chance errors because of the two-choice task.

In each set of comparisons, the poor reader among the mentally retarded is the poorest performer. The mean of 30.16 on the Wepman represents considerable error on a forty item test. The Wepman has thrity word pairs which are different (e.g. bug-bag) and ten word pairs that are the same (e.g. bug-bug). Nine of the ten errors made by the poor retarded readers were in the identification of different (e.g. bug-bag) pairs.

A summary of the reading data indicates that good-to-poor comparisons tend to form a pattern that shows that poor readers of either intellectual sample are inferior to good readers. The retarded-average comparisons do not produce as consistent a pattern. When retarded-average differences do occur, these differences are likely to be attributed to the original differences in reading and mental age. Deficits of the retarded-poor reader sample seem to suggest a degree of deficit in analytic phonic skills.

Psychomotor Comparisons

The range and character of abilities dealt with in this section is comprehensive. The basic intent of such an extensive battery is to provide data that will assist educators in moving toward the development of evaluative strategies, treatment techniques, research efforts and theoretical positions relative to the impact of these traits upon reading. The tactic wherein a research worker investigates the role of one form of behavior (e.g. psycholinguistic characteristics) often leads to a conclusion relative to that behavior and its relationship with reading. The inference is that the behavior under study is characteristic of a child with a reading disability, whereas other behaviors are not. This type of inference is unfounded. Selective utilization of instrumentation, which is generally in concert with the interests of the investigator, leads to conclusions that are specific to that instrumentation only.

The major components of the psychomotor phase of this investigation have been selected because of their frequency of occurrence within the various theories of reading disability. To illustrate, Orton (1937) who supports a neurophysiological theory, Smith and Carrigan (1959) who have developed a synaptic transmission model as an interpretation of the physiological nature of reading disability, and Pearson (1952) who discusses the diminished capacity to learn as a problem in ego psychology, present symptoms of reading disability which relate to problems of attention, associative and conceptual learning and selected types of psychomotor behavior. Although not all inclusive, the former are representative of the theories of disability which include similar symptomatology. It is the nature of these symptoms in children of divergent mental abilities which is a major concern in the present investigation.

Visual Perceptual Abilities

The Developmental Test of Visual Perception and an Embedded Figures Test are utilized as the primary measures of visual perceptual abilities.

Data specific to eye-motor coordination are contained in Table 23. There are no significant differences on either the good-poor or retarded-average comparisons.

TABLE 23

VISUAL PERCEPTION: EYE-MOTOR COORDINATION

		Good	Poor
Average	$\bar{X}$	20.80	20.08
	SD	2.66	2.02
Mentally Retarded	$\bar{X}$	20.56	21.00
	SD	2.96	3.25

Raw Scores	F	p
Retarded-Average	0.38	NS
Good-Poor	0.06	NS
IQ x Reading	1.10	NS

Figure-ground pathology has been of interest to research workers for a number of years. On this particular test, the subject is expected to discern shifts in perceptions of figures against increasingly complex backgrounds. Figure-ground discrimination, Table 24, is not an area which differentiates good and poor readers or retarded and average children.

TABLE 24

VISUAL PERCEPTION: FIGURE-GROUND

		Good	Poor
Average	$\bar{X}$	19.40	18.96
	SD	0.91	2.39
Mentally Retarded	$\bar{X}$	19.16	18.20
	SD	1.07	2.71

Raw Scores	F	p
Retarded-Average	1.67	NS
Good-Poor	0.06	NS
IQ x Reading	1.10	NS

The data for another measure, wherein the child is required to select a figure that has been embedded in a pattern, are contained in Table 25. A total of ten figures are presented to each child and he is instructed to reproduce the standard (e.g. the stimulus figure) that is contained in a more complex pattern. As the data show, there are no significant differences in the number of correct responses among the various samples.

TABLE 25

VISUAL PERCEPTION: EMBEDDED FIGURES

		Good			Poor
Average	$\bar{X}$	7.72			6.68
	SD	2.25			2.84
Mentally Retarded	$\bar{X}$	6.00			5.84
	SD	2.81			2.37
Raw Scores			F	p	
Retarded-Average			6.15	NS	
Good-Poor			1.35	NS	
IQ x Reading			0.73	NS	

The ability to recognize selected geometric figures and to discriminate these from similar geometric figures is the basic definition for Constancy-of-Shape. An analysis of the scores, Table 26, of good and poor readers and of average and retarded children does not show any tendency toward significant differences.

The data for two additional measures of visual perception are presented in Tables 27 and 28. These data show significant differences within the retarded-average comparisons. When the data are adjusted for the mental age-reading age differences, no significant differences are noted. Neither position-in-space or spatial relationships demonstrate significant differences between good and poor readers.

TABLE 26

VISUAL PERCEPTION: CONSTANCY-OF-SHAPE

		Good	Poor
Average	$\bar{X}$	12.48	12.36
	SD	2.58	2.58
Mentally Retarded	$\bar{X}$	12.24	11.16
	SD	2.35	3.08

Raw Scores	F	p
Retarded-Average	1.83	NS
Good-Poor	1.27	NS
IQ x Reading	0.81	NS

TABLE 27

VISUAL PERCEPTION: POSITION IN SPACE

		Good	Poor
Average	$\bar{X}$	7.60	7.40
	SD	0.65	0.87
Mentally Retarded	$\bar{X}$	7.24	6.80
	SD	0.78	1.15

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	7.42	.01	Good-Good	-1.25	NS
Good-Poor	3.29	NS	Poor-Poor	-2.03	NS
IQ x Reading	0.46	NS			

TABLE 28

VISUAL PERCEPTION: SPATIAL RELATIONSHIPS

		Good	Poor
Average	$\bar{X}$	7.20	7.12
	SD	0.71	0.60
Mentally Retarded	$\bar{X}$	6.76	6.48
	SD	1.27	1.01

Raw Scores	*F*	*p*	Residual Scores	*t*	*p*
Retarded-Average	8.39	.01	Good-Good	-2.73	NS
Good-Poor	0.94	NS	Poor-Poor	-2.03	NS
IQ x Reading	0.29	NS			

The *Developmental Test of Visual Perception* also provides a total score. Table 29 contains this summation and, as can readily be observed, there are no overall significant differences.

TABLE 29

VISUAL PERCEPTION: TOTAL SCORE

		Good	Poor
Average	$\bar{X}$	67.56	65.92
	SD	4.63	4.74
Mentally Retarded	$\bar{X}$	66.20	63.60
	SD	5.08	6.04

Raw Scores	*F*	*p*
Retarded-Average	3.18	NS
Good-Poor	4.23	NS
IQ x Reading	0.23	NS

The developers of the DTVP do not suggest that this test should be considered as predictive of reading abilities in the higher grades. The author's statement, in this regard, suggests that older children utilize higher thought processes as compensations for visual perceptual difficulties. The type, role, and influence of these higher thought processes should be identified, particularly where poor readers such as the mentally retarded children in this study (i.e. reading grade equivalent of 1.98) are frequently deficient at the perceptual and conceptual levels of reading. That is, they have poor word recognition; severe deficits in the use of specific reading skills; and, generally, reading comprehension is poor.

Previous research (Cawley, Burrow and Goodstein, 1968) showed significant, but low, correlations between the DTVP and reading achievement. When the DTVP subtests were entered into a multiple-regression prediction of reading achievement, the DTVP subtests were not found among those measures that significantly contributed to the MULT-R. As will be seen later, the same is true in this study.

The simple correlation strategy which examines the relationship between visual perceptual abilities and reading achievement is not a particularly satisfying tactic. The research by the developers of the DTVP indicates that in the normal first-grade, the magnitude of the correlations between visual perception and reading are between .40 and .50. These correlations are similar to those between teacher's judgment and reading and between reading and a host of other variables. As a result of the relatively modest levels of these correlations, unaccounted variance is greater than identified variance.

It is difficult to delineate the behavioral prerequisites for success in reading or to clearly identify which traits will differentiate good readers from poor readers; and, once the differentiation is made, to identify those that represent crucial parameters of reading (Cawley and Goodstein, 1968). Rosen (1968), for example, provided visual perceptual training to first grade experimental classes. Control classes received additional reading instruction. Experimental subjects proved to be significantly superior to control subjects on measures of visual perception; control classes were superior on selected aspects of reading achievement. Johnson (1963) concluded from a comprehensive study of learning and perceptual disorders, that his data do not support the proposition that perceptual disorders create interference in learning. The field is open to a variety of needed research.

Visual-Motor Integration, Table 30, is not an area of assessment that significantly differentiates good and poor readers or retarded and average children.

TABLE 30

VISUAL-MOTOR-INTEGRATION

		Good	Poor
Average	$\bar{X}$	14.88	14.64
	SD	2.62	2.93
Mentally Retarded	$\bar{X}$	14.28	13.36
	SD	3.01	2.97

Raw Scores	F	p
Retarded-Average	2.65	NS
Good-Poor	1.01	NS
IQ x Reading	0.35	NS

The comparative status of visual-motor integration, when examined by transforming raw scores to age equivalents, is approximately two years below mental age for the four samples. Assuming that the estimates of mental age and visual-motor development are reasonable, it is difficult to explain the lag. Visual-motor development is considerably below reading age equivalent for the good readers, whereas it approximates the reading age of the poor readers.

Should one conclude that this measure of visual-motor integration fails to differentiate among the various samples because there is an apparent deficit throughout the entire propulation? If so, it appears that some youngsters can learn to read effectively in spite of such a lag. Is it possible, that the measure of visual-motor integration, although moderately related to reading, is not a highly contributing component to the reading process?

Visual and Auditory Attention

Measures of visual and auditory attention are among the variables that have been described as differentiating good and poor readers. The following appear to be characteristic of severely retarded readers: visual span for non-verbal materials superior to auditory span for verbal materials; auditory span for related materials superior to auditory span for unrelated materials; visual span for non-verbal materials superior to visual span for verbal materials (Cawley, 1967; Johnson, 1957).

The first area under consideration is oral directions, Table 31. This is a complex task in which the subject listens to a set of oral directions and he provides a graphic response to these directions (e.g. Draw a line under the fish and place a mark on the car). These data differentiate good and poor readers. The differences in the retarded-average comparisons is found to be non-significant after statistical analysis of residual scores.

Two additional measures of auditory attention, Tables 32 and 33, also differentiate between good and poor readers. The tasks require the subject to repeat a series of related words (sentences) and a list of unrelated words in response to an auditory stimulus.

TABLE 31

AUDITORY ATTENTION: ORAL DIRECTIONS

		Good	Poor
Average	$\bar{X}$	9.68	7.04
	SD	3.89	5.25
Mentally Retarded	$\bar{X}$	5.88	4.16
	SD	4.02	2.94

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	16.50	.01	Good-Good	.11	NS
Good-Poor	7.03	.01	Poor-Poor	1.25	NS
IQ x Reading	0.31	NS			

TABLE 32

AUDITORY ATTENTION: RELATED WORDS

		Good	Poor
Average	$\bar{X}$	65.68	61.32
	SD	12.88	12.36
Mentally Retarded	$\bar{X}$	59.16	48.16
	SD	13.84	18.09

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	11.56	.01	Good-Good	-1.36	NS
Good-Poor	7.04	.01	Poor-Poor	-1.21	NS
IQ x Reading	1.32	NS			

TABLE 33

AUDITORY ATTENTION: UNRELATED WORDS

		Good	Poor
Average	$\bar{X}$	41.64	39.80
	SD	7.44	5.39
Mentally Retarded	$\bar{X}$	42.60	34.48
	SD	7.58	7.49

Raw Scores	F	p
Retarded-Average	2.40	NS
Good-Poor	12.54	.01
IQ x Reading	4.98	NS

Visual memory for objects and letters is measured as a segment of the inquiry on attention span. In each instance, a sequence of objects or letters is presented and the subject is instructed to repeat the sequence after the standard has been removed. Table 34 contains data relative to attention span for objects. There are no significant differences in the retarded-average or good-poor comparisons.

TABLE 34

VISUAL ATTENTION SPAN: OBJECTS

		Good	Poor
Average	$\bar{X}$	49.32	48.16
	SD	6.01	4.87
Mentally Retarded	$\bar{X}$	49.60	45.00
	SD	7.56	6.06

Raw Scores	F	p
Retarded-Average	1.35	NS
Good-Poor	5.40	NS
IQ x Reading	1.93	NS

By contrast, Table 35, there are significant differences on the good-poor analysis relating to attention span for letters. The retarded-average differences are non-significant after adjustment for the original mental age and reading age differences. The reader will recall that the assessment of letter recognition did not demonstrate any significant differences among the samples. The assumption is warranted, therefore, that the inability to reproduce a sequence of letters from memory is not a function of a lack of knowledge of these letters.

TABLE 35

VISUAL ATTENTION SPAN: LETTERS

		Good	Poor
Average	$\bar{X}$	20.00	17.96
	SD	2.52	3.19
Mentally Retarded	$\bar{X}$	18.16	13.40
	SD	4.56	4.92

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	16.65	.01	Good-Good	.38	NS
Good-Poor	19.79	.01	Poor-Poor	.13	NS
IQ x Reading	3.01	NS			

Associative Learning

Dificiencies in associative learning may exist in individuals who are otherwise normal, and may lead to difficulty with reading. Certain relationships among results of associative learning tests appear to be characteristic of these cases: achievement with a visual-auditory presentation superior to achievement with a strictly visual presentation; greater difficulty with forming associations with word-like figures than with geometric figures; improvement in ability to make associations when voco-motor clues are added to the visual and auditory; achievement on a verbal opposites test below the mental age level established by a verbal test of intelligence. Certain of these same characteristics appear in achieving readers, however. Also, disturbances of attention and concentration may affect ability in this area (Johnson, 1957).

The Van Wagenen Czech Words test contains five words. The subject is told that he is going to learn some new words and that the examiner will tell him the English names for these words. The Czech words are printed on cards and as the card is exposed, the examiner gives the child a name for the word. The child repeats the word after the examiner states it. The combination of the auditory-visual stimulus and a verbal restatement of the stimulus word by the child maximizes involvement in the activity. Criterion is attained when the subject is able to repeat the list of words twice in succession.

TABLE 36

VAN WAGENEN CZECH WORDS

		Good	Poor
Average	$\bar{X}$	5.88	8.32
	SD	4.84	6.47
Mentally Retarded	$\bar{X}$	8.08	9.08
	SD	4.69	5.84

Raw Scores	F	p
Retarded-Average	0.79	NS
Good-Poor	1.23	NS
IQ x Reading	1.23	NS

There are no significant differences in the number of trials to criterion between good and poor readers and between retarded and average children. The mean trials to criterion for the good reader among average children, by inspection, is fewer than for other samples. They are not, however, significantly less.

The Gates Associative Learning Tests comprise four sets of paired-associative tests. Each test contains ten items. The visual geometric and visual word-like tests are composed of ten items each in which a common object is paired with a geometric or word-like associate. The auditory-geometric and auditory word-like tests pair a geometric or word-like symbol with an auditory stimulus.

The data presented herein are based upon the number correct on the first and last trial in a series.

First trial data on the visual geometric task indicate that approximately three items are learned on the first trial by each of the four samples. This increases to a mean of about eight correct. There are no significant differences between good and poor readers, or between retarded and average children.

TABLE 37

ASSOCIATIVE LEARNING: VISUAL-GEOMETRIC, TRIAL 1

		Good	Poor
Average	$\bar{X}$	3.24	3.56
	SD	1.81	1.98
Mentally Retarded	$\bar{X}$	3.60	3.48
	SD	1.98	1.56

Raw Scores	*F*	*p*
Retarded-Average	0.15	NS
Good-Poor	0.07	NS
IQ x Reading	0.36	NS

TABLE 38

ASSOCIATIVE LEARNING: VISUAL-GEOMETRIC, TRIAL 4

		Good	Poor
Average	$\bar{X}$	8.84	8.52
	SD	1.65	1.83
Mentally Retarded	$\bar{X}$	7.64	7.84
	SD	2.38	2.53

Raw Scores	F	P
Retarded-Average	4.88	NS
Good-Poor	0.02	NS
IQ x Reading	0.37	NS

The visual word-like tasks have been shown to be extremely difficult for retarded children (Davis, 1968) and proportionately difficult for adequate readers (Stauffer, 1948) and for poor readers (Raymond, 1955). The current data show approximately two items learned on trial one and an increase to four or five

TABLE 39

ASSOCIATIVE LEARNING: VISUAL WORD-LIKE, TRIAL 1

		Good	Poor
Average	$\bar{X}$	1.28	2.00
	SD	1.17	1.12
Mentally Retarded	$\bar{X}$	1.80	1.68
	SD	2.12	1.18

Raw Scores	F	P
Retarded-Average	0.12	NS
Good-Poor	1.06	NS
IQ x Reading	2.07	NS

TABLE 40

ASSOCIATIVE LEARNING: VISUAL WORD-LIKE, TRIAL 5

		Good	Poor
Average	$\bar{X}$	5.20	5.64
	SD	2.25	2.22
Mentally Retarded	$\bar{X}$	3.92	4.40
	SD	2.31	2.80

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	6.86	.01	Good-Good	-.86	NS
Good-Poor	0.91	NS	Poor-Poor	-.82	NS
IQ x Reading	0.00	NS			

correct on the fifth trial. Retarded-average differences are not maintained after the residual scores are subjected to statistical analysis.

Data specific to performance on trial 1 and trial 4 of the auditory-geometric tests are contained in Tables 41 and 42.

TABLE 41

ASSOCIATIVE LEARNING: AUDITORY-GEOMETRIC, TRIAL 1

		Good	Poor
Average	$\bar{X}$	6.12	6.44
	SD	1.67	2.63
Mentally Retarded	$\bar{X}$	6.00	5.20
	SD	2.16	1.91

Raw Scores	F	p
Retarded-Average	2.16	NS
Good-Poor	0.32	NS
IQ x Reading	1.74	NS

TABLE 42

ASSOCIATIVE LEARNING: AUDITORY-GEOMETRIC, TRIAL 4

		Good	Poor
Average	$\bar{X}$	9.88	9.44
	SD	0.33	1.71
Mentally Retarded	$\bar{X}$	9.24	8.92
	SD	2.17	2.02

Raw Scores	*F*	*p*
Retarded-Average	2.85	NS
Good-Poor	1.22	NS
IQ x Reading	0.03	NS

The ability to perform the auditory geometric task is adequately developed among good and poor readers and among average and retarded children. There are no significant trial one or trial four differences. Performance approximates an attainment level of ninety percent correct on trial four.

The final paired-associate comparisons are on auditory word-like tasks, Tables 43 and 44. These data do not show any significant first or fifth trial differences between good and poor readers. Fifth trial differences between retarded and average children are not maintained after treatment of the residual scores.

The use of the Gates Associative Learning Test as a clinical device has been discussed in the literature (Cawley, 1967; Johnson, 1957; Kingsley, 1968). The clinical patterns are used, along with other information, to assist the clinician in determining an appropriate word-learning procedure for the child with a reading problem. The subjects in this study are not as seriously impaired as many of the children who are referred to reading clinics. Further research with children of varying degrees of reading disability would provide more clarification in the use of this technique.

TABLE 43

ASSOCIATIVE LEARNING: AUDITORY WORD-LIKE, TRIAL 1

		Good	Poor
Average	$\bar{X}$	2.56	3.40
	SD	1.53	2.06
Mentally Retarded	$\bar{X}$	2.44	2.76
	SD	1.58	1.83

Raw Scores	F	p
Retarded-Average	1.16	NS
Good-Poor	2.70	NS
IQ x Reading	0.54	NS

TABLE 44

ASSOCIATIVE LEARNING: AUDITORY WORD-LIKE, TRIAL 5

		Good	Poor
Average	$\bar{X}$	8.12	8.08
	SD	2.09	2.69
Mentally Retarded	$\bar{X}$	5.68	7.16
	SD	3.08	3.16

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	9.09	.01	Good-Good	-1.45	NS
Good-Poor	1.67	NS	Poor-Poor	- .81	NS
IQ x Reading	1.86	NS			

Language Development

Selected basic language characteristics were assessed as part of the developmental comparisons in this investigation. Table 45 contains a summary of the intergroup comparisons on the verbal opposites test. There are significant differences between the levels attained by retarded and average subjects. These differences are not significant after the data are adjusted to accommodate the original differences in mental age and reading age.

TABLE 45

LANGUAGE DEVELOPMENT: VERBAL OPPOSITES

		Good	Poor
Average	$\bar{X}$	42.08	37.16
	SD	7.46	9.72
Mentally Retarded	$\bar{X}$	33.60	23.84
	SD	10.81	9.10

Raw Scores	*F*	*p*	*Residual Scores*	*t*	*p*
Retarded-Average	33.96	.01	Good-Good	-1.56	NS
Good-Poor	15.40	.01	Poor-Poor	-1.73	NS
IQ x Reading	1.67	NS			

The *Goodstein Language Acquisition Determinant* (GLAD) constituted the major measure of grammatical usage. The GLAD, an author developed test, utilizes cloze procedure to assess grammatical constraints on production and recognition of simple sentences (Semmel, *et al.*, 1967). Forty sentences of four words each were constructed from five simple sentence types. Two deletions per sentence type per position in the sentence were randomly made. All words employed in the sentences were drawn from a list of the 500 most frequently used words by first graders (Rinsland, 1945).

TABLE 46

LANGUAGE DEVELOPMENT: GLAD MULTIPLE CHOICE

		Good	Poor
Average	X̄	17.84	15.20
	SD	1.86	2.40
Mentally Retarded	X̄	15.60	10.92
	SD	2.52	2.74

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	46.11	.01	Good-Good	-1.25	NS
Good-Poor	58.12	.01	Poor-Poor	-1.81	NS
IQ x Reading	4.51	NS			

TABLE 47

LANGUAGE DEVELOPMENT: GLAD FREE RESPONSE

		Good	Poor
Average	X̄	16.40	14.92
	SD	1.96	2.63
Mentally Retarded	X̄	14.00	10.12
	SD	2.65	3.57

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	42.46	.01	Good-Good	- .80	NS
Good-Poor	23.53	.01	Poor-Poor	-1.30	NS
IQ x Reading	4.72	NS			

TABLE 48

LANGUAGE DEVELOPMENT: GLAD TOTAL

		Good	Poor
Average	$\bar{X}$	34.24	29.40
	SD	3.23	6.03
Mentally Retarded	$\bar{X}$	29.56	20.16
	SD	4.31	6.98

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	42.43	.01	Good-Good	-1.26	NS
Good-Poor	44.40	.01	Poor-Poor	- .82	NS
IQ x Reading	4.55	NS			

Two tests were then formed by randomly splitting the forty sentences into two parallel forms of twenty sentences. For one form (multiple-choice), a grammatical-meaningful closure was supplied as well as three distractors, a grammatical-unmeaningful, an ungrammatical-meaningful, and an ungrammatical-unmeaningful closure. The other form required a free response. Directions for test administration and the list of sentences comprising the two forms of the test may be found in Appendix C. Although scores along the dimensions of the distractors may be developed, only the number of correct closures are utilized for comparisons in this study.

The data significantly differentiate good and poor readers. The differences between the retarded and average samples are likely to be attributed to developmental factors, such as mental age, inasmuch as the differences between these samples were non-significant after statistical analysis of residual scores.

Poor readers appear retarded in certain aspects of language ability. Unfortunately, no causal status may be conferred upon a linguistic deficit from the design of this study. Future studies should be undertaken employing refined measures of linguistic development administered prior to the first grade predicting later reading achievement. Such studies would help untangle the dilemma of causation.

Visual Retention

The Revised Visual Retention Test, Form C, consists of ten printed designs. The administration of this test can be accomplished in one or more of four different ways. In this investigation, each design was immediately reproduced from memory after a ten second exposure.

There are no inferences in the test manual concerning the relationship between performance on this test and reading disability. The primary emphasis in this measure relates to the detection of cerebral anomalies. The author does report that twenty cases of reading disability, 9-11 years of age, performed well within normal limits. There is the suggestion that reading disability in older children is a specific deficit that is not likely to be reflected in broad visuoperceptual disturbances. Chansky (1966) studied the intercorrelations among the Benton Visual Retention Test (Total Correct) and measures of reading, spelling and arithmetic. In one sample of 123 school dropouts, CA 16-22, the r's were .45, .43 and .51 respectively.

The data reported herein consist of the total correct responses, Table 49, and analyses of the error scores in terms of the six categories suggested in the manual. There are significant differences in the number of correct reproductions between retarded and average children. There are no significant differences between good and poor readers. Treatment of the residual scores reduces the differences between good-retarded readers and good-average readers to a non-significant level; the comparisons between the poor readers indicated that mentally retarded readers are significantly inferior.

TABLE 49

VISUAL RETENTION: TOTAL CORRECT

		Good	Poor
Average	$\bar{X}$	5.68	5.60
	SD	1.77	2.02
Mentally Retarded	$\bar{X}$	4.20	3.88
	SD	2.61	1.99

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	14.22	.01	Good-Good	-2.16	NS
Good-Poor	0.22	NS	Poor-Poor	+3.43	.01
IQ x Reading	0.08	NS			

The performance of the average samples, approximately ten years of age, falls within the average-to-high average range on the test norms. The performance of the retarded samples, approximately thirteen years of age, is representative of the performance of retarded children. The attainment of the retarded children is sufficiently below expectancy to strongly indicate the existence of a deficit in visuo-motor function or visual memory. What this infers, when it is noted that one of the samples reads at its mental age expectancy, is not clear.

The total number of errors, Table 50, is not significantly different for the retarded-average or good-poor comparisons. The data do show, from inspection that the retarded-poor readers do tend to make more frequent errors.

Of the six types of errors, Tables 51 through 56, displacement and size errors significantly differentiate retarded and average children. The adjustments between the samples, to accommodate mental age and reading age differences, resulted in a continuance of the statistically inferior performance of poor-retarded readers as contrasted with poor-average readers. Comparisons between good readers were non-significant.

TABLE 50

VISUAL RETENTION: TOTAL ERRORS

		Good	Poor
Average	$\bar{X}$	5.52	6.96
	SD	2.49	3.70
Mentally Retarded	$\bar{X}$	6.88	8.16
	SD	4.79	5.12

Raw Scores	F	p
Retarded-Average	2.37	NS
Good-Poor	3.68	NS
IQ x Reading	0.01	NS

TABLE 51

VISUAL RETENTION: DISPLACEMENT ERRORS

		Good	Poor
Average	$\bar{X}$	0.28	1.00
	SD	0.46	1.19
Mentally Retarded	$\bar{X}$	2.60	2.08
	SD	2.53	2.23

Raw Scores	F	p	Residual Scores	t	p
Retarded-Average	0.28	.01	Good-Good	-2.28	NS
Good-Poor	0.08	NS	Poor-Poor	-3.23	.01
IQ x Reading	2.95	NS			

TABLE 52

VISUAL RETENTION: SIZE ERRORS

		Good	Poor
Average	$\bar{X}$	0.0	0.0
	SD	0.0	0.0
Mentally Retarded	$\bar{X}$	2.88	1.96
	SD	4.11	2.72

Raw Scores	*F*	*p*	Residual Scores	*t*	*p*
Retarded-Average	24.17	.01	Good-Good	2.57	NS
Good-Poor	0.87	NS	Poor-Poor	-5.22	.01
IQ x Reading	0.87	NS			

TABLE 53

VISUAL RETENTION: OMISSIONS ERRORS

		Good	Poor
Average	$\bar{X}$	0.72	0.88
	SD	0.94	1.30
Mentally Retarded	$\bar{X}$	0.68	1.28
	SD	1.11	1.46

Raw Scores	*F*	*p*
Retarded-Average	0.55	NS
Good-Poor	2.44	NS
IQ x Reading	0.82	NS

TABLE 54

VISUAL RETENTION: DISTORTION ERRORS

		Good	Poor
Average	$\bar{X}$	3.04	3.76
	SD	1.99	2.24
Mentally Retarded	$\bar{X}$	2.84	4.12
	SD	3.08	3.67

Raw Scores	F	p
Retarded-Average	0.02	NS
Good-Poor	3.14	NS
IQ x Reading	0.25	NS

TABLE 55

VISUAL RETENTION: PERSERVERATION ERRORS

		Good	Poor
Average	$\bar{X}$	0.40	0.48
	SD	0.65	0.77
Mentally Retarded	$\bar{X}$	0.96	0.68
	SD	1.46	1.14

Raw Scores	F	p
Retarded-Average	3.25	NS
Good-Poor	0.23	NS
IQ x Reading	0.73	NS

TABLE 56

VISUAL RETENTION: ROTATION ERRORS

		Good	Poor
Average	$\bar{X}$	1.04	0.84
	SD	0.84	1.07
Mentally Retarded	$\bar{X}$	1.20	0.88
	SD	1.19	1.13

Raw Scores	F	p
Retarded-Average	0.22	NS
Good-Poor	1.49	NS
IQ x Reading	0.08	NS

An analysis of the remaining error categories, (e.g. omission, distortion, perseveration and rotation) did not produce any significant retarded-average or good-poor differences. The infrequent occurrence of significant differences on qualitative measures, the error score analysis, suggests that retarded and average children of approximately the same mental age levels are more likely to be quantitatively different.

Lateral Dominance.

There is considerable literature, albeit contradictory, specific to the problem of lateral dominance (Cawley, 1967). Harris (1956) notes that there is more than a relationship between lateral dominance and reading disability. The inconclusive nature of the literature, coupled with a desire to examine lateral dominance amidst an array of additional variables, suggested that a test of lateral dominance should be included in this investigation.

The Harris Test of Lateral Dominance were administered to one hundred and twenty-seven children. The population was dichotomized into samples that were classified as strong lateralization or weak lateralization. Eighteen subjects were classified as weak lateralization and one hundred and nine were classified as strong lateralization. The mean reading grade equivalent for the strong sample was 3.54 and the mean reading grade equivalent for the weak sample was 4.47.

A point biserial correlation coefficient of -.12 was computed between reading and lateral dominance. The data obtained for this study do not lend support to the position that suggests there is a relationship between reading and lateral dominance. This applies only to the population of this study. There are too many unanswered questions that prevent generalizations. One of these issues relates to the fact that there were only eighteen weak lateralized subjects when, in effect, there were fifty poor readers.

STRUCTURAL COMPONENTS

Intercorrelations Among Project Variables

Previous research (Cawley, 1966) inquired into the tight circularity that comprises reading achievement and the diagnosis of specific disabilities in reading skills. As can be seen in Table 57, the measures of reading do not tend toward a pattern in which there is a great deal of independence. This particular problem plagues research workers and clinicians who are constantly searching for indices of specific achievement deficits. The extent to which these measures are so consistently related suggests that considerable difficulty would be encountered by the clinician who attempted to treat these as isolated entities. It is probable, that when attention is given to one area, there will be carry-over effects upon all other areas. The search for specific reading abilities is probably masked by more of a generalized response pattern. The interrelationships among reading abilities is, perhaps, so consistent that a logical explanation can be tendered

TABLE 57
INTERCORRELATION MATRIX FOR GATES-MCKILLOP READING DIAGNOSTIC TESTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1. Total Reading	*	-45	-09	-27	-69	-49	91	88	76	35	30	31	63	41	47	62	51	76	15	1.
2. **Omissions		X	-10	-03	23	25	-47	-51	-27	-38	-50	-54	-39	-33	-32	-42	-27	-35	-12	2.
3. **Additions			X	10	21	04	-01	00	-01	04	06	01	02	-08	-01	09	10	04	07	3.
4. **Repetitions				X	06	13	-16	-13	-13	05	-4	-08	-02	12	10	-12	04	-11	00	4.
5. **Mispronunciations					X	58	-69	-72	-51	-35	-31	-29	-67	-53	-49	-56	-37	-59	-27	5.
6. **Reversals						X	-52	-55	-34	-16	-24	-27	-39	-22	-29	-33	-26	-39	-23	6.
7. Flash Presentation of Words							X	95	78	32	30	29	70	41	48	61	50	82	21	7.
8. Untimed Presentation of Words								X	79	35	28	26	73	41	54	64	54	85	25	8.
9. Recognition and Blending									X	31	18	17	59	34	55	61	56	83	20	9.
10. Letter Sounds										X	45	39	42	45	47	51	47	32	21	10.
11. Identifying Capital Letters											X	92	27	27	25	41	36	18	09	11.
12. Identifying Lower-Case Letters												X	23	26	18	36	33	16	08	12.
13. Nonsense Word Pronunciation													X	54	59	62	50	69	17	13.
14. Initial Sound														X	60	41	42	36	20	14.
15. Final Sound															X	58	59	51	15	15.
16. Vowel Sound																X	54	58	20	16.
17. Auditory Word Blending																	X	55	14	17.
18. Syllabication																		X	18	18.
19. Auditory Discrimination																			X	19.

* r = .21 significant at the .01 level of confidence

** Negative correlations reflect error scores concerning the teaching of reading. Specific (e.g. teaching reading by teaching specific skills such as letter sounds) approaches to the teaching of reading, when contrasted with generalized approaches (e.g. the sight vocabulary stress in the basal reader) do not seem to reduce the prevalence of reading disability cases among their respective samples. Specific and generalized approaches seem to have a great deal of overlap and the probability is that when behavior is effected in one area, it is likely to be effected in another.

TABLE 58

INTERCORRELATION MATRIX FOR SELECTED PSYCHOMOTOR TESTS

	1	2	3	4	5	6	7	8	9	10
1. Eye-Motor	*	14	-02	22	41	66	18	42	27	35
2. Figure Ground		X	02	16	25	49	20	27	15	13
3. Constancy of Shape			X	14	24	56	11	22	22	34
4. Position in Space				X	51	49	25	36	43	43
5. Spatial Relationship					X	68	40	39	43	58
6. DVTP: Total						X	34	53	44	56
7. Informal Word Discrimination							X	26	16	30
8. Visual-Motor Integration								X	44	51
9. Visual Retention Total									X	50
10. Embedded Figures										X

* r = .21 significant at the .01 level of confidence

The intercorrelation matrix for selected psychomotor tests, Table 58, shows that thirty-five of the forty-five correlation coefficients are significantly different from zero. The expressed relationship among these measures is quite consistent, although the magnitude of their relationship do not account for a great deal of variance. This should not suggest cause-and-effort. The circularity that was cited among measures of reading is also apparent in the psychomotor area.

TABLE 59

INTERCORRELATION MATRIX FOR READING AND PERCEPTUAL-MOTOR TASKS

	Total Reading	Flash	Untimed
Embedded Figures	.18	.25	.27
Visual Retention: Total	.11	.12	.16
Visual-Motor Integration	.19	.24	.27
Informal Word Discrimination	.23	.20	.21
Eye-Motor	.09	.08	.08
Figure-Ground	.18	.22	.25
Constancy of Shape	.15	.16	.16
Position in Space	.20	.23	.23
Spatial Relationships	.11	.11	.14
DTVP: Total	.26	.27	.28

r = .21 significant at the .01 level of confidence

The relationships among the psychomotor tasks and the relationships among the reading measures does not approach the consistency that is expressed when these measures are viewed within their own framework. There is no indication that psychomotor traits and reading characteristics are substantially related among children in this population. The marked differentiation among these abilities is evident in the factor analysis which follows.

Factor Analysis

Principal component factor analysis, from which rotated varimax loadings were obtained, was also used in the search for structural components in the data obtained in this investigation. These factors are contained in Table 60. Four factors, accounting for fifty-three percent of variance, have been identified and included for discussion. The eigenvalue at this point was 2.55. Extracting these data to an eigenvalue of 1.00 yielded eleven factors that accounted for seventy-three percent of variance. Each of these additional factors accounted for such a small amount of variance (i.e. range from 2 to 4 percent) that it was decided to limit the discussion to only four factors. A loading equal to, or greater than, .50 was judged appropriate for inclusion in a factor.

TABLE 60

FACTOR ANALYSIS OF SELECTED PERFORMANCE MEASURES

Total Percent of Variance = 52

Factor I

Percent of Variance = 30

Word Recognition Untimed	.92
Word Recognition Flash	.91
Syllabication	.90
Total Reading	.87
Recognition and Blending	.87
GLAD: Multiple Choice	.78
GLAD: Total Score	.78
Nonsense Word Pronunciation	.73
GLAD: Free Response	.69
Vowel Sound	.67
Mispronunications	-.65
Verbal Opposites	.63
Auditory Word Blending	.61
Final Sound	.57

Factor III

Percent of Variance = 6

Embedded Figures	.74
Spatial Relationships	.72
Position-in-Space	.71
DTVP: Total	.67
Eye-Motor Coordination	.53

Factor II

Percent of Variance = 11

Van Wagenen	-.80
Visual Geometric, trial 4	.80
Auditory Geometric, trial 4	.80
Auditory Word-like, trial 5	.79
Auditory Geometric, trial 1	.59

Factor IV

Percent of Variance = 6

Letter Recognition: Lower Case	.90
Letter Recognition: Upper Case	.88
Omissions (Errors)	.63

The first factor is composed of reading and language characteristics. The Gates-McKillop subtests, the verbal opposites and the measures of language usage load heavily on this factor.

The second factor is an associative learning factor. It includes the Van Wagenen Czech Words and four items from the Gates Tests of Associative Learning.

Perceptual development characteristics constitute the third factor. The Embedded Figures Test and the Developmental Test of Visual Perception compose the factor. It appears to be independent of the reading and language factor.

The structure of this factor is similar to one discovered in a project with six-year old children (Cawley, Burrow, and Goodstein, 1968) in which a clear-cut reading factor was also identified. Reading and perceptual attainment load on different factors in the present study in a pattern similar to that in the previous research. Comparable data are reported by Rosen and Ohnmacht (1968). Their data are based on a study of first grade children. A reading achievement and a perceptual readiness factor were clearly identified among the six factors obtained.

The fourth factor, which accounts for six percent of variance, is composed of letter recognition and a word recognition error, omissions.

Multiple-Regression

Step-wise multiple regression, Table 61, which was employed to predict the total reading score from among the variables in this investigation, produced a MULT-R of .70. This was attained after three steps. The "F" value of the last increment was 4.08 ($p < .01$). The multiple-choice segment of the Goodstein Language Acquisition Determinent, the total correct score of the Benton Visual Retention Test and the total correct score of the Wepman Auditory Discrimination Test comprised the structure of this MULT-R. Behaviorally, these are characterized by a measure of language usage, a measure of visual memory and a measure of auditory discrimination. Measures of perceptual development, associative learning and learning aptitudes did not enter the regression equation. Similarly, these traits tended toward a low order correlation with reading and, as was noted in the factor analysis, they did not load on the reading-language factor. For the population of the present study, it seems reasonable to posit that reading is a behavior that is a highly developed entity. The possibility exists that more effective and efficient instructional procedures for the teaching of reading should be developed, and until the contribution of low-order correlates of reading is determined, the diagnostic/teaching stress need not necessarily be along these dimension. Research, however, is definitely warranted.

TABLE 61

STEP-WISE MULTIPLE REGRESSION OF TOTAL READING SCORE

Variable	B-Weight	Standard Error	t	p
Wepman Auditory Discrimination Test: Total Score	.70	.24	2.96	<.01
Benton Visual Retention Test: Total Correct	-.91	.45	-2.02	NS
Goodstein Language Acquisition Determinant: Multiple Choice	2.69	.31	8.67	<.01

MULT-R = .70

Number of steps = 3

Constant Term = 22.74

Standard Error of Reading = 10.74

"F" level of last step = 4.08

Conclusions and Recommendations

This project investigated selected elements of reading and psychomotor characteristics among good and poor readers of divergent intellectual abilities.

The data that are presented in this study are subject to the limitations that are found in any study of this type. Testing conditions could have been better; the teams of examiners could have worked together for longer periods, thereby, furthering the effectiveness of the data acquision procedure; a larger population, reflecting different socio-economic levels, chronological ages and intellectual levels might have been utilized; basic experimental tactics and propositions could have balanced the developmental type of assessment practice that was employed herein. All of the aforementioned would have added to the dimensions of this research effort. At the same time, average and retarded children who were good and poor readers were treated under comparable conditions.

As is the case with most research in the behavioral sciences, this study focused on the similarities and differences among the mean scores of selected samples. This necessity of using group data to suggest individual characteristics is a sensitive issue. To illustrate, the current data show that retarded and average children tended not to be significantly differentiated on the majority of measures. Yet, through the use of the IBM 1627 high resolution plotter unit, the comprehensive profiles of each of the twenty-five retarded poor readers were graphed. An analysis of these graphs failed to produce any common syndrome among these youngsters. The relevant question becomes, therefore, "Is it possible to arrive at an educationally relevant conclusion specific to the nature of reading disability when the individuals within an experimental sample vary to a greater extent than do the data between samples?" Harris (1967) referred to this problem in a study of the effectiveness of different methods of teaching beginning reading.

Add to the above, the fact that numerous research efforts, primarily because they were properly in concert with the research worker's interests, have produced data that demonstrate support for nearly any position that an investigator is able to study. The major obstacle to the derivation of treatment related symptomatology is the fact that most research workers function independently and for limited periods of time. Comprehensive research efforts, of a longitudinal nature, are essential if any basic truths are going to be uncovered in this area. Hopefully, The National Advisory Committee on Dyslexia will recommend this as one priority item. Centers, strategically located throughout the country could study basic processes, diagnostic-treatment factors, developmental trends (e.g. at what age are poor readers no longer characterized by deficits in visual and/or auditory perception?) the characteristics of children of divergent mental abilities and the ultimate reading attainment among children and the relationship of these factors to the training of teachers and clinicians.

Under this type of model, selected behavioral measures could be administered to children of varying degrees of reading disability at specified age intervals. The data could be entered into a multiple regression equation and those that make the most substantive contribution to the reading dimensions would be retained. Simultaneous with laboratory experimentation of these variables is the need to add other behavioral measures to the assessment process. Those that contribute significantly to the prediction of reading would continue in the manner described above. The data from the various centers would be assimilated and the parameters of the reading process delineated. As diagnostic data and theory merge, treatment models could be developed.

Certain dimensions of the above discussion are vital if the process of reading is to be understood. Research has failed to detail those behavioral traits that are essential to the reading process. The current investigation identified both good and poor readers among the retarded and average children. Good readers were reading at their mental age levels. Reading - or more comprehensively stated, academic achievement - would seem to be the dependent variable that is more relevant to school authorities than is intelligence. Intelligence will continue in the primary role as long as education is required to attain age-in-grade expectancies. The age-in-grade expectancy forces teachers to process children at rates that are inferred from current practice. Prescriptive teaching, that is diagnostically based and built upon individual responsiveness to specific tasks, is a needed entity for today's children. Data from an earlier study (Cawley, Burrow and Goodstein, 1968) provided the basis for an expression of concern relative to evaluative procedures and dependent variable selection. This concern is further substantiated by the present investigation.

The performance of good readers was approximately two and one-half years superior to poor readers. Good readers among retarded and average children demonstrated reading levels that were equivalent to their derived mental ages. Poor readers were performing at levels that were two and one-half years below mental age.

Good and poor readers were often differentiated on measures of reading; they were infrequently differentiated on measures of psychomotor characteristics. Poor reading retarded children were substantially inferior to the other samples on measures of reading skills. The interrelationships among the measures of reading were such that it is difficult to identify specific deficits. Those children who were inadequate in one area seemed to be relatively inadequate in others, although no particular group pattern was observed. We have no clear data that would indicate that reading programs for the poor readers should have a skill-to-meaning orientation, or vice-versa. There are no data to warrant support for the use of measures of percepto-motor behavior as the basis for intervention tactics among poor readers of either intellectual level.

What seems more important is an attempt to relate treatment to diagnosis in individual cases, in addition to studies of experimental and control samples. Furthermore, the scores on the individual must be carried into the developmental programs of the elementary school. It is vital that teachers, both at the undergraduate and graduate level, be sufficiently trained in educational diagnosis, the prevention of failure in individuals, and techniques through which children can proceed at their own rate. The entire notion of school failure might be reconstructed if the attention of teacher education is focused in this direction. Teachers will then be able to work with children and not have to search for labels in order to explain to the community "Why Johnny Can't Read."

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APPENDIX A

VISUAL AND AUDITORY PERCEPTUAL FACTORS IN READING

VISUAL AND AUDITORY PERCEPTUAL FACTORS IN READING[1]

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A paper prepared for The Task Force, *Treatment Configurations in Educational Settings*, of the *Interdisciplinary Committee on Reading Problems*, Center of Applied Linguistics, Washington, D. C.

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Central to the problem of visual and auditory perceptual factors in reading disability is a distinction between perceptual development and perceptual learning.

Perceptual development is defined as the developmental aspect of perception that organizes and stabilizes the environment, or in the case of reading, those characteristics that enable the child to differentiate and identify stimuli.

Perceptual learning may be defined (Gibson, 1963) as any relatively permanent and consistent change in the perception of a stimulus array, following practice or experience with this array.

Perceptual development is the level at which reading clinicians and educators generally operate. At this level, achievement testing is the typical strategy. The emphasis is on how adequately a child provides a suitable response to stimuli, usually on a basis of a few trials on a few items that sample a defined behavior. Illustrative of this technique are the Developmental Test of Visual Perception and the Detroit Tests of Learning Aptitude.

Perceptual development, because of relatively modest correlations with parameters of reading, is used as a predictor of success in reading and in describing the characteristics of children who are having difficulty in learning to read.

Visual Perceptual Development

Gibson (1966) suggests that the change from oral language to reading takes place in three parts; differentiation of graphic symbols; learning to decode letters to sounds; using units of structure of a progressively higher order.

The ability to discriminate letters, differentiation of graphic symbols, has been shown to be a highly significant predictor of first grade reading achievement (Barrett, 1965b; Shay, 1968).

Barrett (1965a) in his exhaustive review of the literature found the ability to discriminate verbal materials (letters and words) in general to be a better predictor of reading achievement than ability to discriminate non-verbal materials, although relationships between the latter and first grade reading achievement are by no means absent. Goins (1958) and deHirsch (1966) found moderate correlations between even more primitive levels of visual perceptual organization and reading achievement.

If one views perceptual development as hierarchical, proceeding from gross to finer levels of functioning, the available research may be subject to a reasonable analysis. Visual discrimination of letters and words, being closer to criterion abilities directly underlying initial reading instruction, will correlate higher with beginning reading than an ability to perform a visual perceptual task at a grosser level, simply because the former ability requires attainment in the prerequisite task. Neisser (1967) in an analysis of pattern recognition research concludes that preschoolers often look at pictures without bothering to turn them right side up. He also notes that when children were confronted with a task in which they were required to select a stimulus that looked exactly like a standard, preschool children had more difficulty with those stimuli which manifested rotations. Neisser suggests there is a general indifference to rotation at the preschool level and he posits that failure to match a standard is a discrimination problem.

Money (1962; 1966) argues that failures to discriminate letters and words may indicate a failure to move from inventory to concept memory. Inventory memory is employed to catalog items in the child's environment. These items are subject to the law of object constancy. That is, they remain that object regardless of perspective, upside down or right side up. Alphabetic characters and words, however, obey the laws of directional and form constancy. Letters derive meaning from their direction or orientation, and minor changes of form do affect the meaning of letters, if not chairs. These laws are developed within concept memory. Failure in linguistic discrimination may involve a large "cognitive" component in addition to perceptual development.

Prior to the time that research workers can clarify the role of perceptual factors in the treatment of reading problems in educational settings, it will be necessary to uncover a list of prerequisites which are fundamental to the process of learning to read. Our present list, although comprehensive, is not particularly impressive because the list contains so many variables that we are unable to specify those that are crucial to reading. The term crucial suggests that they are so relevent to reading that the child who does not possess them will not learn to read. At the same time, we must discover if the child who is intact will always become a successful reader.

Auditory Perceptual Development

Since reading involves the decoding of visual stimuli into auditory language patterns, auditory perceptual abilities should also be related to efficiency in reading. Auditory discrimination of words has been found to be a moderately high predictor of initial reading achievement. (Hanesian, 1966; Harrington, and Durrell, 1955; Nila, 1953; Thompson, 1963; Wepman, 1960). However, little is known about the relationship of auditory abilities at grosser levels with subsequent auditory discrimination of words and ultimate reading achievement.

Feldman and Deutsch (1966), in a review of literature, cite data that show (1) auditory discrimination capability increases with chronological age, (2) a positive relationship between auditory functioning and reading abilities in the early grades, and (3) auditory training facilitates reading readiness. On the other hand, the authors cite data that show no relationship between reading and auditory skills. The relationship that does occur is more likely to be established in younger children than in older children. There is a possibility that the perceptual impediments to reading that occur in young children are masked by more conceptual processes in older children. Older children compensate for perceptual difficulties, whereas younger children openly manifest them. This may partially explain the fact that treatment via auditory and visual perceptual training may effect younger children to a greater extent than older children.

Auditory-Visual Integration

Perceptual learning gives consideration to trials-to-criterion, the child's performance during a specific treatment, control of stimulus materials, pretraining and the relationship of the experiment to theory. An example of this laboratory approach to the study of the role of auditory-visual integration performance in predicting reading disability follows:

Muehl and Kremenak (1966) concerned themselves with the ability of children to match information within and between auditory and visual modalities and the relationship that this ability might have to reading achievement. First grade children were confronted with tasks which required them to provide an auditory or visual matching response to an auditory or visual stimulus. To illustrate, in the auditory/visual matching tasks the child would hear a pattern of dots and dashes, then see on a card a pattern of dots and dashes. He would indicate whether the pattern seen was the same as, or different from, the one heard. The same tactic was utilized with the auditory/auditory, visual/auditory and visual/visual matches. Pretraining was provided prior to each treatment. Visual/visual matches proved to be the easiest, auditory/auditory the most difficult, and the auditory/visual and visual/auditory matches were of intermediate difficulty. A statistical analysis showed that the letter naming tests contributed so highly to the prediction of reading achievement, that it was decided to examine the relationship of letter naming to the modality components under investigation.

The V/A and A/V tasks correlated significantly with letter naming, .40 and .53 respectively. The data show that only one of 14 children who had a low A/V score at the beginning of the year appeared in the high reading group. Of those children with high A/V scores, twice as many ended up in the high reading group. The ability to relate information from the auditory to the visual sense was markedly associated with reading achievement. The role of the auditory matching ability made no independent contribution to reading achievement. The relationship, therefore, of auditory discrimination in reading readiness and remedial reading instruction should be further evaluated. The magnitude of the correlation between letter naming and reading achievement, .82, far outstripped the correlation of the V/A and A/V matching training. The evidence points to the need for the early identification of children with deficiencies in the ability to integrate modalities in order to maximize their achievement.

Training in Visual Perception

Tachistoscopic training of the recognition of capital letters, an association task, has been found to improve future performance by kindergarten children on a multiple-choice matching visual discrimination task with letters. In one study (Wheelock and Silvaroli, 1967), the performance of children from lower socioeconomic classes was especially enhanced. Popp (1967) has demonstrated that a program of multiple-choice matching tasks involving reversable letters, bigrams and trigrams could significantly improve visual discrimination ability in an experimental group of kindergarten children. Popp also notes that the correlation of discrimination test scores with later reading achievement may indicate that an ability to discriminate does influence reading achievement or that some underlying common factor exists which produces high scores on both measures; the same might be said in the case of low scores. Effective programming that provides a means of observing and controlling a subject's interaction with specific instructional materials will assist in a greater understanding of these issues.

Goins (1958) found that practice of tachistoscopic perception of numbers could improve the span of apprehension for numbers in an experimental group of children in the first grade; however, no significant improvement in reading achievement was found for the experimental sample.

Gibson (1966) believes the most relevent kind of discrimination training is practice which provides experience with characteristic differences that distinguish sets of items. Although the child can learn to read without the letter emphasis, difficulty in transferring to new words is likely to be encountered. However, no training program, operating from this theoretical position has yet been proposed and tested.

Training in Auditory Perception

Silvaroli and Wheelock (1966) found that auditory discrimination training with both nonsense and meaningful words significantly increased performance by kindergarten children of low socio-economic status on the Wepman Test of Auditory Discrimination.

Curriculum development in auditory discrimination has received only minor attention. Feldman and Deutsch (1966) developed an auditory perceptual training program for use with disadvantaged children. This curriculum included sound recognition, sound discrimination, auditory memory and attentivity. In this program, the same auditory skills were taught in the same sequence by all tutors in the study. Among the activities included were (1) environmental sounds; identification of environmental sounds; (2) following directions; the child was given oral directions and he carried out an assigned task; (3) words; this included the repetition of words and rhymes, (4) sounds of letters and letter combinations; child supplied words which had given sound or they learned to associate letter sounds and names, (5) blending sounds; child blended sounds without the aid of visual cues, (6) listening to stories, and (7) telling stories.

The authors report little success for their program used as a remedial tool with third-grade disadvantaged retarded readers. This, however, should not preclude experimentation with the program used as a developmental tool in reading readiness. Feldman and Deutsch recommend further study. The sparcity of experimental studies of facilitation of auditory perceptual behavior in educational settings points to research needs in this area.

Other Approaches to Training

Investigation of the integration of various perceptual modalities often carries implications that some children may be more efficient with one specific perceptual input, and thus should show a preference for learning to read by that specific stimulus modality. However, Bateman's (1967) research on modality effectiveness and differential programming with first grade children indicates that the auditory oriented programs are substantially more beneficial than visually oriented programs. Bateman identified children whose scores on the auditory sequencing and visual motor sequencing memory tests of the ITPA indicated a modality strength in either the visual or auditory processes. The overall auditory abilities of the youngsters was approximately nine months higher than their visual abilities. Those youngsters who scored nine or more months higher on auditory tests than in visual were classified as auditory modal and reading instruction was provided through an auditory program. Those youngsters whose auditory memory was lower than nine months above visual memory were classed as visual modal and were taught reading through a more visual approach. Two other samples of mixed subjects were taught with one of the two approaches. Auditorally modal subjects scored higher than visually modal subjects in their respective programs and the auditory methods seemed superior to the visual methods in the mixed groups. A valuable addition could have been made to the study had the relative strengths of the two modalities contrasted in the four groups been equated.

Consistent gains from developmentally designed readiness programs must be contrasted with typical results of remedial effects. Perhaps, the success of developmental programs may be attributed to designing the curriculum around treatment rather than fitting treatment into a curriculum formally designed for children who made normal progress through school. In treating children with reading problems, there exists a serious question relative to the validity of a school system that is organized around twelve (or any other fixed number) grades. Would these youngsters ultimately perform at significantly higher levels if the stress was on the development of competencies, rather than the attainment of grade level? For professional educators and lay persons, the twelve-year system is a convenience for children who are not able to respond to it, it is a tragedy.

The implications of this query can be elaborated on a basis of data relevant to the long-term post-remedial progress (Buerger, 1968; Balow, 1965). In both of these reports, immediate gains are noted at the completion of treatment. Yet, in each instance, the progress of the participants fell below the remedial rate. Assuming, of course, that pre-to-post test gains are not influenced by regression, these are firm bases for reviewing the structural sequence of public school education.

One of the problems in discussing treatment programs is the success of programs which operate from very different theoretical positions, and use quite different approaches in remediation. The goal of educational psychologists must be to find the common denominators of treatment that appear quite different upon surface analysis.

Johnson (1963) studied the relationship between perception and learning in the mentally retarded. This is a comprehensive study that focused upon basic learning processes (e.g. serial learning, paired associate learning, concept formation) in experimental situations that varied in inclusion of visual and/or auditory background interference. Of particular relevance to this paper is a sub-study that contrasted the performance of children with low (poor) perceptual scores and children with high (good) perceptual scores. There was no significant differences between high and low samples on (1) serial learning, (2) paired associate learning and transfer, (3) coding and proactive inhibition, (4) concept formation, and (5) on ten of twelve comparisons of visual discrimination learning and transfer. The conclusion drawn by the principal investigator was that the evidence from the study does not support the proposition that perceptual disorders create interference in learning.

In a companion study, Chiappone (1963) failed to find any pattern of significant differences between high (good) and low (poor) perceptual samples on a variety of measures of reading.

These studies are limited by the fact that the samples were limited to mentally retarded children. However, two studies (Cawley, Burrow and Goodstein, 1968; Cawley, Goodstein and Burrow, 1968) contrasted various patterns of visual and auditory perceptual behavior among children of divergent intellectual levels. In the latter study, mentally retarded children who were classified as good and poor readers were compared with average children who were classified as good and poor readers. There were more than sixty variables measured. There were almost no significant mentally handicapped-normal differences; good-to-poor differences were found for variables which were directly related to reading skills, but not on measures of visual perceptual development. Measures of auditory discrimination presented a similar pattern.

The research of Harrington and Durrell (1955) contrasted the reading ability of children who were high and low in auditory discrimination. The high performing pupils were significantly superior to the low performing pupils in reading ability, a pattern which was not found in the studies previously cited.

Kline, et al. (1968) described the treatment of reading problems in a community health center. The treatment program was multi-sensory in nature, built upon a good foundation in phonics. The treatment stressed a combination of Gillingham and the McCracken-Walcutt Basic Reading Series. Children were seen daily for approximately one hour per session and the results were consistently positive. Forty-six of fifty children improved substantially, with thirty-one improving to the extent that they were considered to be normal readers. The gains of young children were substantially greater than those of older children.

Haring and Hauck (1968) individually programmed the sequence of instruction under learning conditions that systematically applied motivational variables. The subjects were four elementary school boys who were severely retarded readers. These boys were incorporated into a highly structured reading environment that contained a teacher station, four student stations, and a reinforcement area. Data on responses made during the treatment period showed that the youngsters increased their responsiveness to reading (e.g. the number of correct responses increased) and that gains ranged from one and one-half years to four years, following five months of instruction.

Gallagher (1960) conducted a study to determine the effects of tutoring on brain-injured mentally retarded children. The perceptual abilities, as measured by the ability to reproduce geometric designs from copying and memory, showed marked improvement, although this growth was attributed to maturation and not to tutoring.

Overall, children who showed unusual growth in one area of development were more likely to show unusual growth in other areas. The indications are that the younger child was more likely to make significant gains.

One of the more comprehensive texts which gives attention to the treatment of auditory and visual perceptual deficits (Johnson and Myklebust, 1967) abounds with practical and realistic educational suggestions, but it simply lacks the data which are necessary to preclude other treatments based upon comparable diagnosis, nor is there any indication of the success of the suggestions under discussion. Admittedly, we have not attained sufficient maturity in these areas to warrant more than a modest statement of clinically demonstrated techniques. Frostig and Maslow (1968) raise some interesting points relative to the ability to train various language traits, some of which have strong auditory or visual perceptual components. Utilizing the original edition of the Illinois Test of Psycholinguistic Abilities, Frostig discusses some of the principles that underlie language training. The sum total of Frostig's analysis seems to be that the ITPA is not an all-inclusive language system. Therefore, it is necessary to incorporate other strategies into a system that will more adequately deal with a complete range of auditory/visual perceptual processes and language development skills. A training program based upon the ITPA will include training in percepto-motor abilities and training in thought processes. Concomitantly, training in visual perceptual processes must also improve language. The suggestion is that a training program built around the ITPA needs to be supplemented by other techniques. It is further suggested that the Developmental Test of Visual Perception would be a worthy supplement through which language skills could be developed. The notion is certainly worthy of investigation.

The face value of the aforementioned cannot be accepted without controlled experimentation. Rosenberg (1968) for example, states that the ITPA is not based upon a viable model of linguistic competence and performance and that it does not reflect recent work in the area of developmental psycholinguistics. He also notes that the theory upon which the ITPA was originally developed has been modified.

This review of efforts to train specific perceptual abilities raises more questions than it answers. At the kindergarten level, specific training appears to facilitate performance in the skills trained. One indication of transfer of training from one type of behavior to another has been reported. However, the influence of perceptual training upon subsequent reading achievement, when this training is introduced after kindergarten, has not been found significant.

Rosen (1968) in a well designed study, randomly assigned 12 experimental first grade classrooms to a twenty-nine day adaptation of the Frostig Program of the Development of Visual Perception, in addition to their regular reading instructional program. Thirteen control classrooms received additional reading instruction for an amount of time comparable to that in which the experimental group was receiving perceptual training. The experimental classrooms were significantly different from the controls in post-test scores on perceptual measures. However, at the end of the school year, no significant differences in favor of the experimental group were found on the New Developmental Reading Tests. Control children were statistically superior on one reading subtest which measured understanding the main idea of a paragraph in two of the three experimental analyses.

Structured programs in reading that train the perceptual abilities are more effective than the informal readiness activities usually employed in kindergarten in promoting first grade reading achievement, (Hillerich, 1965; Shoephoerster, Bernhart, and Loomer, 1967). Shoephoerster, et al., found that the structured program was most effective with below average IQ children. In two longitudinal studies (Hillerich, 1965; Brzenski, 1964, and McKee and Brzenski, 1966) the gains of children employing a structured commercial program (Getting Ready to Read) in first grade were followed up for the subsequent grades. From this latter study, it appears that those children who received the training in kindergarten are significantly better readers in the latter grades as well. The most gains were made by a group of children who were placed in an adjusted reading curriculum in the first five grades to follow up the gains that were made in kindergarten. The necessity of employing longitudinal designs in this area was demonstrated by Jordan (1963). Dr. Jordan contrasted a first grade readiness program with the traditional first grade reading program for low IQ children. The children in the traditional program were significantly better readers until the fifth grade, when the experimental group caught up and began to pull ahead in reading achievement.

Hively (1966) has constructed a framework for the evaluation of perceptual training. He classifies three types of stimuli and responses; spoken symbols, written symbols, and their non-verbal referents. Matching tasks and association tasks may employ either multiple-choice or free-response modes. These tasks may employ various combinations of the three stimuli and responses. Multiple-choice matching tasks involve the familiar matching-to-sample format. For example, the choice would be a matching task with written stimuli and written responses. A free-response matching task with these stimuli and response modes might involve copying written symbols. Similar tasks may be demonstrated involving the other two stimulus and responses mode.

Hively notes that association tasks require that the stimulus mode and response mode be different. An example of a multiple-choice task of association would be selecting a word from two choices that match with a non-verbal stimulus (picture or object). A free-response association task with these stimulus and response modes might involve writing the word in the presence of a picture or object. The six combinations of these three stimulus and response modes are described. Hively does not discuss original learning discrimination tasks. They could probably be classified as a third type of matching task, multiple choice in absence of a standard. No attempt has yet been made to put these tasks into any sequential system of learning. However, at least a reasonable scheme for analysis of perceptual behavior has been constructed, awaiting experimental implementation.

Discussion

A fundamental consideration in the above is that a behavior can be defined and measured, a proposition that suggests that it can be observed and reproduced (e.g. it has stability). It should also be subject to modification. If the behavior in question cannot be modified and the dependent variable (reading) is modified, then the behavior, at best, is a correlate of the disability, not an impediment. If the behavior cannot be modified and progress in reading is impeded, the behavior might be described as truly characteristic of reading problems.

If the behavior in question is modified, and reading is improved, then the behavior might then be described as influencing reading behavior; if the behavior is modified and reading is not, the role of the behavior must be examined.

Diagnosis and treatment in educational settings can contribute to a clarification of the above by administering the complete diagnostic battery as a post-test and by studying the patterns of improvement. Additions or deletions to the battery, examined in relation to improvement in reading, will gradually assist in the identification of those areas that are making the most relevant contribution to reading.

In these instances, reading disability may be viewed as a dependent variable, encompassing a range of independent variables that are limited only by the interests and competencies of clinicians and research workers.

Treatment programs might be initiated through the development of training programs that are designed to reduce a correlate of the disability - assuming that this impairs reading - with the treatment ultimately clearing the way for improvement in reading. An example of this could be the utilization of the Development Program in Visual Perception with reading problems. Figure 1 contains a paradigm acceptable to arrive at some determination of the impact of the visual perceptual training program.

Figure 1

Paradigm In Studying the Role of Correlates of Reading

	Visual Perception Training	No Visual Perception Training
Reading		
No Reading		

Research workers have not yet asked the questions that are necessary for the preparation of this paper, let alone have the answers to them. The questions might run along these lines: What characteristics of the disabled reader could be prevented by what treatment, as detected by what predictors?; and, what characteristics of disabled readers can be treated by what methods, to allow for direct intervention (instruction in reading) or indirect intervention (e.g. training in language to influence reading).

Educators have yet to engage in research that would theoretically establish a hierarchy of perceptual abilities and gradually descend along the hierarchy to determine a point at which good and poor readers are no longer differentiated. From that point, the relative contribution to the reading problem that is made by each level of the hierarchy should be sought.

Pushing this issue one step further, we need to inquire into the feasibility of correlation techniques as predictors of reading. How much of a lack of what trait (or set of traits) will result in a reading problem? Is a correlation of .56, for example, of sufficient magnitude to warrant the inference of a cause and effect relationship?

A determination of the magnitude of the influence of percepto-motor deficits on reading would certainly assist in treatment. How much of what is important? Correlation tactics tend to leave more unexplained variance than the amount that can be accounted for. Correlation coefficients of .30, .50, .70 do not indicate how much of the variable a child needs in order to be successful in reading. They only indicate the relative rank on the two measures.

The ability of the child to compensate for a deficit is also an important factor. Bright children are more likely to compensate for deficits than are slow-learning children; the child with a lesser number of deficits is more likely to compensate for these deficits than a multiple-handicapped child.

The classroom teacher is faced with a comparable problem in compensation. The lesser the frequency of disability, the easier it is to compensate for these disabilities in the classroom. As the prevalence of disability increases, the regular classroom teacher is less able to adapt instruction in order to facilitate treatment. Educational planning should consider the intensity of disability that a teacher can handle. It may be that the homogenous grouping of children with problems creates such a concentration of disability that treatment is seriously hampered.

The extent to which we can train perceptual abilities in the hierarchy of learning tasks in the system of reading is an important issue in education today. When educators are able to structure the learning situation for the child to speed up the maturation of behavioral functions and refine and direct their development, education will take on the look of a diagnostic-prescriptive learning situation. Until that time, there remains a great deal to be done.

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APPENDIX B

INSTRUMENTATION CONTENT

WEPMAN AUDITORY DISCRIMINATION TEST

Purpose:	To assess auditory discrimination ability with verbal material.
Subjects:	Pre-school to late elementary.
Test:	Forty pairs of words are orally presented. Ten pairs are composed of similar, yet different words, while the other thirty are identical word pairs.

INFORMAL VISUAL WORD DISCRIMINATION TEST

Purpose:	To assess visual discrimination ability with verbal material.
Subjects:	Elementary school
Test:	A visual stimulus word is presented and the subject must select from four choices the one which is not the same as the standard.

GATES-McKILLOP READING

Diagnostic Tests

Purpose: To discover causes of reading deficiency in terms of the pupil's unique handicaps.

Subjects: Grade one to grade seven achievement.

Subtests:

I. Total reading achievement

A test of oral reading ability which provides an assessment of present grade level functioning. For diagnostic purposes a series of error scores are also produced. These measure such elements of reading performance as omission of whole words, mispronunciation of any word elements, addition of words,repetition of word phrases and reversal of words in whole or parts.

II. Flash Presentation

Single words are presented to the subject for one half second for visual recognition and oral recall.

III. Untimed presentation

Single words are seen by the subject for oral recall.

V. -1-Recognizing and blending common word parts

Nonsense words composed of real word elements (e.g. sp acts) are presented for subject pronunciation and analysis.

V. -2-Letter Sounds

Letters are visually presented and the subject is required to respond with the isolated sound of that letter.

VI. -3-Final Letter

A similar procedure is used to abstract final letter sounds.

VI. -4-Vowels

Nonsense words were presented as above and the subject was required to indicate what vowel sound had been heard.

VII. Auditory Blending

A real word is broken down into its sound elements and orally presented with a 1/4 second hesitation between elements. The subject must reconstruct the word from its parts and respond to the examiner orally with the whole word.

VIII. -3-Syllabication

Pronunciation by the subject of visually presented nonsense words is required.

VIII. -4-Auditory Discrimination

Pairs of real words are orally presented and the subject must indicate if the words in the pair were the same or different.

DEVELOPMENTAL TEST OF VISUAL PERCEPTION
(DTVP)

Purpose: To diagnose visuo-perceptual disturbance

Subjects: Pre-school through high school, with norms for CA 3-8 1/2

Subtests:

I. Eye-Motor Coordination - a test of eye-hand coordination involving the drawing of continuous straight, curved, or angled lines between boundaries of various width, or from point to point without guide lines.

II. Figure-Ground - a test involving shifts in perception of figures against increasingly complex grounds. Intersecting and "hidden" geometric forms are used.

III. Constancy of Shape - a test involving the recognition of certain geometric figures presented in a variety of sizes, shadings, textures, and positions in space, and their discrimination from similar geometric figures. Circles, squares, rectangles, ellipses and parallelograms are used.

IV. Position in Space - a test involving the discrimination of reversals and rotations of figures presented in series. Schematic drawings representing common objects are used.

V. Spatial relationships - a test involving the analysis of simple forms and patterns. These consist of lines of various lengths and angles which the child is required to copy, using dots as guide points.

DETROIT TESTS OF LEARNING APTITUDE

Purpose: To measure general intellectual performance and to obtain a diagnostic profile of subject performance.

Subjects: Pre-school to high school.

I. Verbal Opposites

A word is orally presented, the response is also oral and must be the opposite of the original.

II. Auditory Attention Span for Unrelated Words

Two sets of unrelated, one syllable words, are auditorily presented. The subject must repeat as many (two to eight) as he can remember.

III. Visual Attention Span for Objects:

Two sets of unrelated, one syllable words are visually presented. The subject must repeat as many (two to eight) as he can remember.

IV. Auditory Attention Span for Related Words:

Meaningful sentences of increasing length are auditorily presented for subject recall.

V. Visual Attention Span for Letters:

Lower case letters, from two to eight in number are visually presented for short periods. The subject must accurately recall each letter set.

VI. Oral Directions:

Oral instructions of increasing complexity must be followed in a paper and pencil situation.

BEERY VISUAL-MOTOR INTEGRATION TEST

Purpose:	A diagnostic orientation for early identification and remediation of visual motor integration.
Subjects:	Pre-school to high school, but mainly for CA 3-6 children.
Test:	Twenty-four geometric designs are visually presented for motor reproduction.

GATES ASSOCIATIVE LEARNING TESTS

Purpose: To assess the associative performance of school children as it might relate to other areas of academic achievement.

Subjects: School age children

Subtests:

I Set A (Four trials)

The subject is briefly shown the picture of a common object and a geometric shape. He is asked to recall the object when shown the figure. No oral cues are given nor is oral rehearsal permitted on the part of the subject.

II. Set B (Five trials)

A similar procedure is used to test the associative performance when objects and word-like configurations are used as stimuli.

III. Set C (Four trials)

A geometric figure is presented visually and associated with an auditorally presented word. Word recall is elicited from the visual stimulus.

IV. Set D (Five trials)

A similar presentation with word-like figures substituted for the geometric figures.

HARRIS TESTS OF LATERAL DOMINANCE

Purpose: To establish the form and degree of lateral functions in an individual.

Subjects: No restrictions

Subtests:

I. Knowledge of Left and Right

Subject must point to different parts of his body on command (e.g. point to your left ear).

II. Hand Preference

Subject is asked to simulate ten actions with the hand of his choice.

III. Simultaneous writing

Subject writes the numbers one to twelve with both hands simultaneously.

IV. Handwriting

Subject writes his name first with one hand and then with the other.

V. Tapping

Subject makes as many dots in a set of squares as possible, first with right hand and then with left.

VI. Dealing Cards

Subject deals a set of cards, first with one hand and then the other.

VIII. -3-Eye Dominance

Subject pretends to sight a rifle, first by holding it up to his eye and then at the shoulder position.

XI. Foot Dominance

Subject first kicks an object with his choice of feet and then with his other foot. He also stamps his foot.

REVISED VISUAL MOTOR RETENTION TEST

Purpose:	To identify brain-injured subjects.
Subjects:	No limitations.
Tests:	Ten geometric designs are individually presented for a limited time, after which the subject motorically reproduces the designs. The scoring system yields several error types (e.g. misplacements) scores.

APPENDIX C

DIRECTIONS AND STIMULUS SENTENCES
FOR THE EXPERIMENTAL EDITION OF THE
GOODSTEIN LANGUAGE ACQUISITION DETERMINANT

GOODSTEIN LANGUAGE ACQUISITION DETERMINANT

Directions to the child for multiple-choice cloze

"In this game I will show you these cards with sentences on them; but there will always be one word missing. In place of the word missing there will be four words. Each one might be used to take the place of the missing word. The idea of the game is for you to choose the word so that the sentence makes good sense. I'll say the sentence to you. As I say the sentence try to follow the words on your card with your finger. When you hear this sound (click), you'll know this stands for the missing word. At the end of the sentence, I will say the four words that might be used to take the place of the missing word. For example, if I say 'This (click) is fun, - games or rest or wood or after, you would choose 'test'. You should choose only one of the four words that I read to you. Whether the word is first or last when I say them to you does not make any difference. The right word may be any of the four words I say to you."

"Let's practice on two more sentences. (pretraining) (upon completion of pretraining) Now let's try some more for you to do all by yourself."

Multiple-choice Cloze sentences

Pre-training 1: The _______ likes cake. - children or boy or wood or toys (ans.: boy)

Pre-training 2: ________ to the store! - run or walks or break or hitting (ans.: run)

THE REMAINING SENTENCES ARE TO BE PRESENTED RANDOMLY

(please continue to substitute or between choice words)

1. All ______ like candy. fathers - child - leaf - gardens
2. Wish ______ happy things! stay - down - a - for
3. _____ story was long. this - an - enough - front
4. Wait until next ______. at - years - nest - time
5. ______ cowboys ride horses. front - guess - a - real
6. Squirrels ______ big teeth. turns - has - have - are
7. ______ on blue paper! writes - letting - draw - live (i as in big)
8. Other people are ______. may - sing - enough - kind
9. Every day ____ hot. catch - is being - was - were
10. ______ leave every fall. desks - ducks - bird - face
11. One nice teacher ______. by - walks - breaks - reads
12. This bad ______ hurts. cut - teeth - bell - hats
13. Kind ladies _______ children. hop - is - help - loves
14. The boy plays ______. butter - blue - football - game
15. New ______ are nice. suns - ball - turn - toys
16. Mother loves yellow ______. flowers - grow - bird - dinners
17. Clean up ______ rooms! car - lost - these - that
18. Another ______ summer came. hot - thank - three - round
19. ______ sick birds fly. hard - no - a - turn
20. Grandmother comes ______ year. every - hold - last - pink

Directions to the child for free-response cloze

"In this game I will show you these cards with sentences on them; but there will always be one word missing. The idea of the game is for you to say the missing word so that the sentence makes good sense. I'll say the sentence to you. As I say the sentence try to follow the words on your card with your finger. When you hear this sound (click), you'll know this stands for the missing word. For example, if I say 'Let's (click) a game,' you can say 'play'. You should say only one word - not more than one. You can use either a long word or a short word - the size of the blank doesn't show how long the word should be."

"Let's practice on two more sentences. (pretraining) (upon completion of pretraining) Now let's try some more for you to do all by yourself."

Free-response Cloze sentences

Pre-training 1: Mother sets the ______. (i.e., table)

Pre-training 2: Father ______ the baby. (i.e., loves, feeds, washes, etc.).

THE REMAINING SENTENCES ARE TO BE PRESENTED RANDOMLY

1. Big ______ want dresses.
2. Walk ______ the store!
3. ______ noses were red.
4. Look at those ______!
5. ______ girls run home.
6. Dogs ______ fine pets.
7. ______ off all food!
8. That lunch was ______.
9. All snow ______ cold.
10. ______ cuts the turkey.
11. The nice sister ______.
12. Many happy ______ new.
13. Little babies ______ milk.
14. Some brothers eat ______.
15. All ______ is green.
16. Daddy buys real ______.
17. Bring in ______ meat!
18. Pretty ______ rabbits jump.
19. ______ old men laughed.
20. Ponies need ______ grass.